AUGUST 1956

GAS

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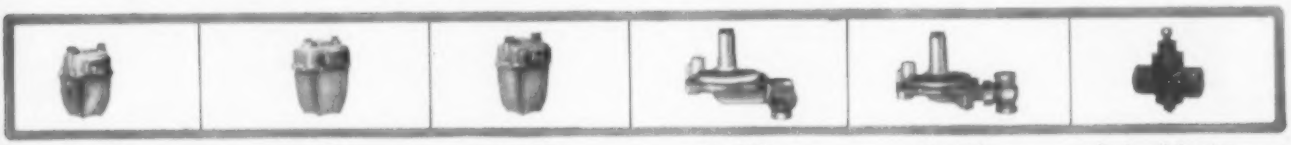

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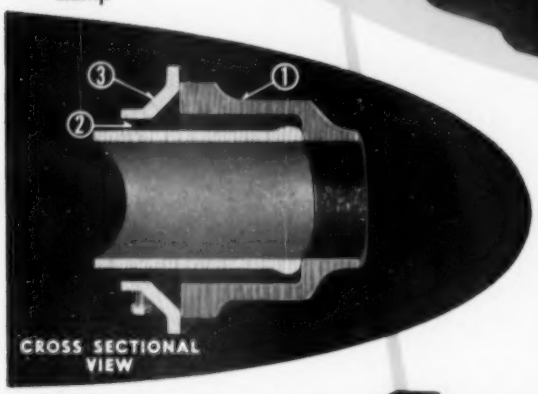

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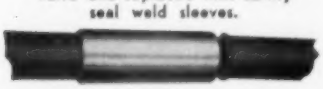

Steel to steel sleeve

Cast to cast sleeve

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GAS

32nd YEAR OF PUBLICATION

IN THIS ISSUE . . . .

The use of an electronic digital computer has saved the Northern Illinois Gas Co. many engineering man-hours. The company hired the Institute of Gas Technology to perform an analysis of its distribution system on the computer. The results of this analysis are described in detail, beginning on page 37. Underground storage's vital role in the gas industry is discussed by Consulting Engineer Douglas Ball on page 95.

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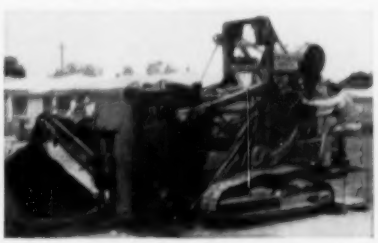

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Once a customer

Photo: Black Star

This is Hartford, Conn., the "Insurance Center of the Western Hemisphere".

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This is Hartford as it looked in 1848 when Hartford Gas Company was founded.

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HARTFORD GAS COMPANY bought cast iron pipe 100 years ago—and buys it today

Hartford Gas Company (formerly Hartford City Gas Light Company) was granted its original charter in 1848. Population of Hartford was then 18,000. In 1849 cast iron distribution mains were laid. One of these mains recently was uncovered and found in good condition after 100 years' service (see cut). Today, this progressive Company is serving 67,000 customers with 535 miles of mains. It has recently completed conversion to a new 800 B.T.U. mixed gas to meet the needs of Greater Hartford's more than 300,000 population.

A famous jurist defined *good will* as "the probability of the customers' returning to the old stand." Hartford Gas Company has been buying cast iron pipe for more than a century. And, even though the pipe they laid in 1849 was made without benefit of engineering specifications, metallurgy and modern quality controls, some is still in service.

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In good condition after 100 years of service, this cast iron gas main is still functioning as part of Hartford Gas Company's modern distribution system.

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GAS Thermally Thinking

Intrastate and interstate gas

SUPPLIERS of natural gas down Texas way are making a big show of funneling produced gas into intrastate commerce. This is an expected outgrowth of the deceased Harris-Fulbright bill. Actually, the situation looks at least temporarily serious as major producers shut-in wells and look for additional intrastate markets.

One producer has gone so far as to start construction on short pipelines that will operate intrastate beyond question. In this specific case, the company had lines in which interstate- and intrastate-destined natural gas was comingled. The new pipeline (a relatively short segment) will sharply divorce the gas slated for the incompatible markets. Other plans and projects in the same vein are well known. The large number of shut-in gas wells is not so well known.

At the moment, the situation is serious. Major transmission companies find that they are having little or no luck in signing gas purchase contracts that are needed to augment depleted portions of their committed reserves. On the other hand, anyone who has or knows of intrastate markets finds both major and independent producers eager to sell. Prices for intrastate gas approach or equal those for interstate markets.

But, how long can the market for intrastate gas remain particularly attractive? How long can producers hold shut-in gas?

It would be fantastic to assume that intrastate markets in the major producing states can utilize the large volumes of natural gas when thinking in terms of the vast interstate gas markets. There just isn't that much population and industry in those areas. The price is bound to drop as the limited intrastate markets saturate. Many feel that this market is already well into the saturated state.

However, some gas companies with extensive production interests are hurriedly working toward development of additional and new intrastate markets. The advances in the technology of petrochemicals lend themselves well to such objectives. New processes utilizing gas as the basic energy medium and basic feed stock are under investigation. Such efforts will produce results.

The independent producer is really caught in the squeeze. He cannot afford to shut in gas for periods in the range that major oil company producers can. He generally has to "turn" his natural gas production to generate capital for further exploration and drilling. He feeds on drilling, producing, and selling; then, he must drill again and again. Generally, he will not be able to hold shut-in gas very long.

With the major producer, it's another story. The integrated oil companies (the major producers of natural gas) can hold out until dooms-day if they want to.

So, the veto of the Harris-Fulbright bill leaves us with many things to consider. Among the more important things is how much gas that is needed by distribution companies (to meet already tried demands for domestic house heating) is going to remain in the producing states shut-in or sold for intrastate consumption. It will be a volume worth thoughtful consideration.

J. Fred Ebdon

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highlights

GAS SPOT NEWS, TRENDS, COMMENT ON GAS INDUSTRY AFFAIRS

Trend in distribution companies toward decentralization of their operating departments and other activities through construction of local service centers is moving rapidly this summer. New service centers crop up throughout the country in relation to efforts by other commercial establishments to bring their stores to heavily populated residential areas. Gas companies report tremendous savings in miles traveled by construction and service trucks.

Summer turns our thoughts to what air conditioning experts have been thinking about all year. Many ideas turning up for consideration. One research facility is studying a new absorption refrigeration cycle that utilizes a small electric motor to circulate refrigerant and absorbent. Servel has its new "Sun Valley" single-coil, all-year unit ready. In the gas engine-driven compression-cycle picture, the Phillips engine is under consideration; as are the free piston engine, Sterling hot-air engine, and several new designs for more convention internal combustion power plants. Miscellaneous physical and chemical ideas are under investigation.

The gas industry can sell air conditioning and needs the loads. The more units of various designs that become available, the better. Right now, it looks as if the gas heat pump will have to be engine driven and will cost more than competition's units, but will run cheaper.

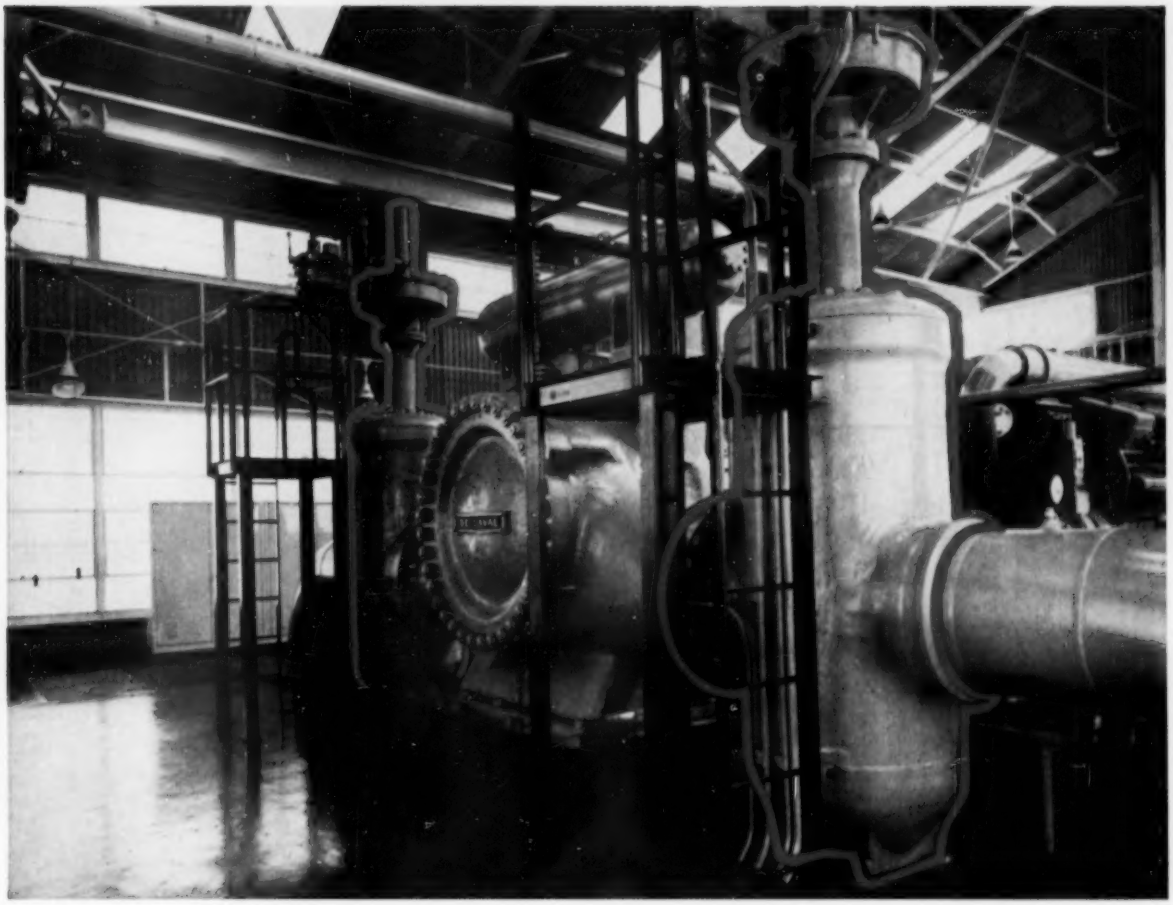
A five-member Crown Corp. has been formed to supervise the construction of Trans-Canada's pipeline. This event immediately followed the approval of an $80 million loan from the Canadian government which allows Trans-Canada to get construction started. The loan was approved just before the Parliament's June 7 deadline.

The huge conversion of Consolidated Edison's gas system to natural gas is nearly completed. July 31 is the target date for the change-over of the last appliance. The job has been done, for the most part, by Con-Ed's own crews—a very creditable task. Following initial adjustments, complaints involved about 5% of the total appliances converted.

Prices for intrastate gas on the Gulf Coast are ranging from 1 to 5 cents/Mcf higher than prices being offered by interstate transmission lines. Interstate buyers cannot meet these prices because FPC feels they are not just. Transmission companies on the Gulf Coast really feel the shortage the price differential creates—eastern distribution companies will feel it too.

Notes from an editor's field book

El Paso Natural and TGT both have new combustion gas turbine stations coming up this year . . . Houston Natural Gas is installing mobile VHF radio units in more of its vehicles after using such communications equipment in Houston and Corpus Christi for some time . . .Customers are learning that some municipal distribution systems are not panning out as expected because tax money saved is going into other, less profitable city functions (or some place) and system maintenance and service degenerates; also, city fathers miss the tax money that private utilities would have paid into the city coffers . . . Portland Gas & Coke now due to get gas from Pacific Northwest's Scenic Inch in the second half of August; incidentally, Pacific now is the largest single stockholder (25%) of Westcoast Transmission. Westcoast Investment Corp., a Pacific Northwest subsidiary, holds this block . . . a test application of plastic tape was made on 10 miles of 30-in. pipe in the American Louisiana pipeline near Memphis, Tenn.



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*regulatory and legislative trends

Highway reimbursement for utility relocations

THE largest Federal-aid highway bill in history has been adopted by Congress. Nearly $33 billion will be used over a 13-year period to expand and modernize the highways in the United States.

Federal funds derived from new taxes on gasoline, tires and vehicles will pay about 90% of the cost of the 40,000 miles of super interstate highways, with the states paying the balance. Federal payments for primary, secondary and urban roads will total 50% of the cost, with the states matching that amount.

Many millions of dollars will be spent by utilities to relocate facilities necessitated by highway construction, so management has been watching the legislative provision for reimbursement.

The Commerce Department made a study for Congress, which included a review and financial analysis of existing relationships between the state highway departments and utilities affected by required relocation and reconstruction of utility facilities in connection with highway improvements. The financial burden placed on utilities has been heavy. The study revealed that highway construction costs of $1.1 billion had a utility relocation cost of $35.5 million. The relocation cost involving utilities located within the highway rights-of-way amounted to $29.1 million, but utilities were reimbursed only $3.8 million.

Congress recognized the merit of the utilities' contention for reimbursement, and made the following provision relating to the relocation of utility facilities:

"(a) AVAILABILITY OF FEDERAL FUNDS FOR REIMBURSEMENT TO STATES. Subject to the conditions contained in this section, whenever a state shall pay for the cost of relocation of utility facilities necessitated by the construction of a project on the federal aid primary or secondary systems or on the interstate system, including extensions thereof within urban areas, federal funds may be used to reimburse the state for such cost in the same proportion as federal funds are expended on the project: *Provided*, That federal funds shall not be apportioned to the states under this section when the payment to the utility violates the law of the state or violates a legal contract between the utility and the state.

"(b) UTILITY DEFINED. For the purposes of this section, the term 'utility' shall include publicly, privately, and cooperatively owned utilities.

"(c) COST OF RELOCATION DEFINED. For the purposes of this section, the term 'cost of relocation' shall include the entire amount paid by such utility properly attributable to such relocation after deducting therefrom any increase in the value of the new facility and any salvage value derived from the old facility."

Utility customers will be interested in this new law, because a utility's cost of rendering service must be passed on to the customer in rates. Every utility user, therefore, has paid twice for highways when relocation costs have been assessed against the utility. He pays once in taxes and again in higher utility rates.

The mistaken idea that non-productive costs, such as relocation of facilities, can be loaded on utilities without a resulting cost to the consumer was largely responsible for the success which highway officials had in the past in preventing equitable reimbursement legislation.

The Senate Committee reported the acute need for highway modernization, and also showed the magnitude of the need, which one can relate to the prospective major cost of the relocation of utility facilities. That report states:

"Almost every witness at the hearings recommended prosecution of an expanded highway program, with emphasis on completion of the national system of interstate highways. The testimony indicates that the number of vehicles on the highways and the mileage traveled have maintained a steady upward trend since 1945. In 1946 there were 34.4 million motor vehicles on our roads. Today there are over 58 million. It is estimated that by 1965 the total will reach 81 million. Improvement of the nation's highways is lagging. The highways are fast deteriorating and becoming obsolete. Traffic demands far exceed the highways being provided under the existing program. In 1953 our total federal-aid highway needs were estimated to require the expenditure of $35 billion. That estimate is now $68 billion, with the total highway needs of the nation estimated at $101 billion. An adequate highway system is vital to the nation's economy. To provide an adequate system will require vast increases in highway expenditures. We believe the public is aware of this need

*A monthly commentary on national and state developments by an expert in the field of utility law.

and is desirous of immediate action to meet it."

The President considered this highway expansion program one of his most important projects. He called attention to the Clay report to Congress, which revealed the sad consequences of obsolete and unsafe highways. He noted that 36,000 persons are killed and more than 1 million injured each year on the highways. The economic cost of the highway accident toll is estimated to be more than $4 billion a year, with the increased cost of vehicle operation due to the physical condition of the present highways estimated to be $5 billion annually. The need for an adequate road network to permit rapid evacuation of key cities in case of atomic attack was covered also.

The importance of this great highway program to nearly everyone in the United States, including utility ratepayers, is manifest when one realizes how extensive the network is upon which this nation-on-wheels depends. The Senate Committee on Public Works reported:

"The main through roads and interstate roads comprising the principal highways of the nation constitute the primary system. The secondary system consists of farm-to-market routes, rural mail routes, school-bus routes, and county and local roads which feed the local traffic into the primary roads.

"The national system of interstate highways is an integrated network of primary roads which connect the principal metropolitan areas, cities, and industries, and serve the national defense. These highways are the most important portions of the primary system, and are composed of the heaviest traveled main arteries of the nation.

"The federal-aid primary system consists of a total of about 234,400 miles, of which 18,800 miles are in the urban category and 37,600 are included in the national system of interstate highways. The mileage of the secondary system is about 483,000 miles. The total mileage of all federal-aid highways is 717,000. The remaining roads for which the states and other governmental units are responsible consist of approximately 2.6 million miles, of which about 2.3 million miles are rural roads."

The Conference Committee of the Senate and House reached a compromise on reimbursement to utilities for the cost of relocating facilities, and explained the provision, which was enacted, as follows:

"The House bill (sec. 113) and the Senate amendment (sec. 111) contained similar provisions which would have permitted federal funds to be used to reimburse a state for utility relocation costs which the state had paid for under its own laws or practices. Both the House and Senate provisions would have denied apportionment of federal funds for this purpose to any state when the payment to the utility violated the law of the state or a legal contract between the utility and the state. The Senate amendment differed from the House bill, however, in that it provided that no more than 2% of any sum apportioned to any state for any fiscal year might be expended under the section. The House bill contained no such limitation.

"This 2% limitation would have resulted in administrative difficulties. It could have caused inequities particularly to small utilities and municipalities and in some instances resulted in failure to fully reimburse states which would otherwise have been reimbursed under the policy which the Bureau of Public Roads has followed of reimbursing states that pay relocation costs. Section 113 of the bill as passed by the House and recommended and accepted by the conferees recognizes the equity of reimbursing utilities for the cost of relocating facilities when required for federal-aid highway projects. Further, this section makes it clear that it is the intention of the federal government to assume its proportionate share of utility relocation costs

Continued on page 61

Utility facilities are related to the magnitude of the population in the various states, so the following federal-aid highway funds approximate apportionments for the next five years shows where the greatest utility relocations will occur:

Alabama	$254,000,000	New Hampshire	$ 69,000,000
Arizona	146,000,000	New Jersey	249,000,000
Arkansas	182,000,000	New Mexico	155,000,000
California	677,000,000	New York	821,000,000
Colorado	176,000,000	North Carolina	309,000,000
Connecticut	114,000,000	North Dakota	141,000,000
Delaware	68,000,000	Ohio	510,000,000
Florida	207,000,000	Oklahoma	229,000,000
Georgia	290,000,000	Oregon	175,000,000
Idaho	125,000,000	Pennsylvania	621,000,000
Illinois	562,000,000	Rhode Island	73,000,000
Indiana	300,000,000	South Carolina	165,000,000
Iowa	261,000,000	South Dakota	150,000,000
Kansas	240,000,000	Tennessee	264,000,000
Kentucky	228,000,000	Texas	725,000,000
Louisiana	200,000,000	Utah	120,000,000
Maine	97,000,000	Vermont	67,000,000
Maryland	139,000,000	Virginia	244,000,000
Massachusetts	243,000,000	Washington	198,000,000
Michigan	432,000,000	West Virginia	143,000,000
Minnesota	287,000,000	Wisconsin	283,000,000
Mississippi	200,000,000	Wyoming	124,000,000
Missouri	342,000,000	Hawaii	21,000,000
Montana	184,000,000	District of Columbia	74,000,000
Nebraska	187,000,000	Puerto Rico	31,000,000
Nevada	128,000,000		

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Welding fittings Sizes ¾" through 12". Pressures to 1200 p.s.i. at 100° Fahrenheit.

Mechanical joint fittings Sizes 2", 2½", 3", 4", 6" and 8". Pressures to 175 p.s.i. at 100° Fahrenheit.

A complete line of line stopper fittings with working pressures up to 1200 p.s.i. permit you to isolate sections, relocate, repair or tie-in lines under pressure. The entire operation is done in a safe No-Blo® manner, without escape of gas.

All fittings have an internal plug which is threaded into the fitting after the stop-off has been completed. This plug closes the fitting and allows removal of the stopping machines and gate valves.

On 3" sizes and up, the completion plug is equipped with an equalizing valve that maintains equal pressure on both sides of the plug. This balanced pressure assures easy insertion or removal of the plug under pressure.

All fittings may be reopened and reused at any time, or if line is later abandoned, may be salvaged for reuse on other lines.

Ask your Mueller Representative, or write direct, for complete information on these and other Mueller No-Blo® fittings, and the equipment with which they are installed.

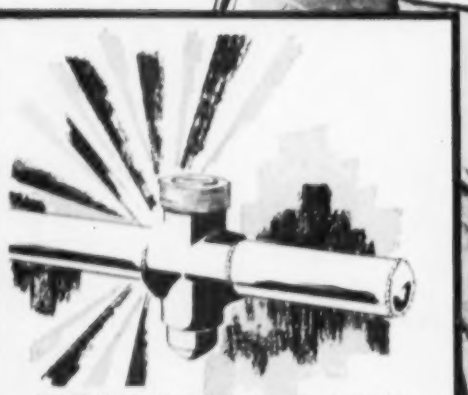
NO-BLO®

MUELLER CO.

Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS

Extend



STEP 1: Attach fitting. When line is laid, weld fitting to line with completion plug in fitting — hand tight. Allow to cool naturally and tighten completion plug. Attach completion cap. Fitting may be uncovered and line extension made as follows.

STEP 2: Open fitting. Remove cap, loosen completion plug and attach extraction tool to plug. Mount gate valve and stopping machine. Unscrew plug, close valve and remove machine.

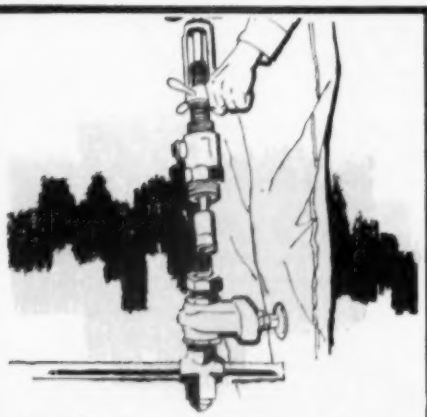
Lines Without *Shutdown*

■ Mueller Extension Stopper Fittings provide a means of extending dead ends without disrupting service to the existing line. Fittings are installed at dead ends as the piping is laid. This provides a simple means for future stop-offs without installing an expensive valve that requires maintenance. When it becomes necessary to extend the line, it can be done in a safe No-Blo® manner, without loss of gas. It is not necessary to drill the fitting before making the stop-off – only the proper size Mueller Stopping Machine is required.

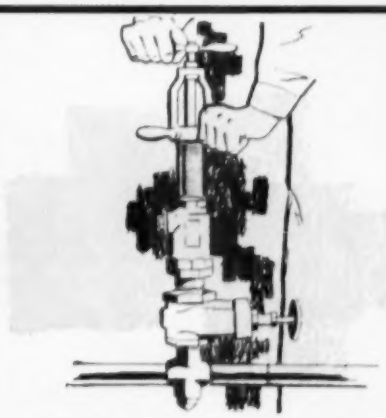
■ Extension stopper fittings for lateral connections permit running a lateral without using expensive gate valves. Fitting is placed in service with a Mueller Stopping Machine, and stop-off is made as described.

■ 1½" and 2" sizes have working pressures to 1200 p.s.i. 3", 4", 6" and 8" sizes have working pressures to 230 p.s.i.

MUELLER NO-BLO® Method



STEP 3: Make stop-off. Attach stopper to inserting bar, lubricate with soap suds and remount machine. Open valve, advance and expand stopper. Cut off end of fitting and weld on new line extension.



STEP 4: Plug fitting. Open equalizing and purging connection. Relax and raise stopper. Close valves, remove machine. Remount machine with completion plug, open valve and insert plug.

STEP 5: Cap fitting. Remove stopping machine and gate valve. Tighten completion plug with wrench. Attach completion cap for double seal. Line has been extended in a safe manner, without loss of gas.

Write for the No-Blo® Method Booklet, "Safe Operating Practice". It shows how other gas installations are made in a safe manner, without escape of gas.

MUELLER CO.

Dependable Since 1857

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WASHINGTON

Lobbyists may run afoul of tax deduction law

By N. R. REGEIMBAL
GAS Washington Bureau

GAS industry men were fairly successful in stamping out the political fires a special Senate committee attempted to kindle during its probe of lobbying activities on the natural gas bill, but there is one flickering flame which refuses to be squelched. It could turn into a real three-alarm problem before long.

This is the allegation during the hearings that many of the firms on both sides which contributed to any of a host of organizations involved in the fight illegally deducted the contributions from income taxes.

Internal Revenue Service is officially mum on the subject, but one top official told GAS privately that there is no doubt in IRS that such deductions are not permitted. He points to IRS Regulation 118, Section 39.23 (o)-1, paragraph f which reads: "Sums of money expended for lobbying purposes, the promotion or defeat of legislation, the exploitation of propaganda, including advertising other than trade advertising, and contributions for campaign expenses, are not deductible from gross income." This applies to individuals as well as corporations.

The rule has remained substantially unchanged for about 40 years, this official says, so there is no excuse for anyone not being aware of it. In addition, it has been argued off and on since it was originally adopted, and the tax collectors have never wavered from their rigid interpretation of it, nor have they, after repeated reconsiderations, amended it.

As to arguments that the campaigns conducted by the organizations in the gas fight come under "educational" activities, and thus contributions are deductible educational gifts, the IRS says in effect, "hogwash." Educational activities in the IRS dictionary refers to scholastic or philanthropic activities, but not to efforts designed to advance selfish motives, no matter how worthy or important they may be, he asserts.

Are tax agents reading congressional testimony and making special reviews of the tax returns of the firms which listed as deductions contributions to these organizations? This official won't say positively, but he quips that "the (tax) boys in the field read the papers; they're on the job, so draw your own conclusions."

If the Revenue Service carries out the implied threat and begins disallowing the millions of dollars contributed to fight for or against the Harris bill, the only remedy apparent now is action through the tax court (which has already upheld the general IRS regulation) and through the appeals court. This, of course, would again keep before the public the unfortunate bad taste which the Case situation produced.

The lobby investigation, headed by one of the Senate's top supersleuths, Sen. John L. McClellan (D.—Ark.), as expected failed to come close to matching some of the spectacular performances for public interest that body has put on in the past. But it has left its mark in another unexpected way.

Cloakroom comments of members of the committee from both parties indicate more than slight displeasure with many of the witnesses, including the unions, some lawyers, as well as officials of the organizations called to testify. As these hearings moved along, steaming hot weather had turned Washington into a sea of sweaty shirts, limp trousers and testy tempers. Witnesses didn't like being there; didn't like the implications in the probe or their being called to testify, and the lawmakers were short tempered as they sought to wind up business for the year and head for more friendly, and perhaps cooler, climates.

Whatever may have been the reasons, however, many of the committee members were complaining that the witnesses seemed flip, slightly arrogant, and displayed little or no respect for the prestige of Congress. That's not a charge to be taken lightly, because it was the President's complaint of "arrogant lobbying" that as much as anything else touched off the probe. Whether or not the charge is justified, it can only hurt the gas industry's cause in general when any new gas bill gets started again.

It's interesting to note that the lawgivers rarely criticize anger displayed at hearings—that they can understand, and almost expect. But they are highly sensitive to what they believe is any show of less than the proper awe at their position (no matter how justified).

Principal pitch of the gas indus-

Continued on page 64

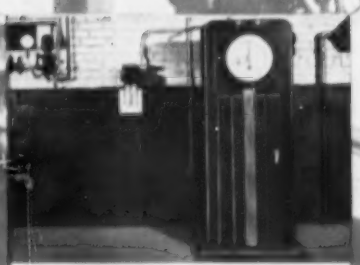
Pipeline Companies Prove
Btu CONTROL IS PROFIT CONTROL

The Nation's Successful Gas Transmission Companies Depend on Cutler-Hammer Recording Calorimeters to Know the Value of What they Buy and Sell

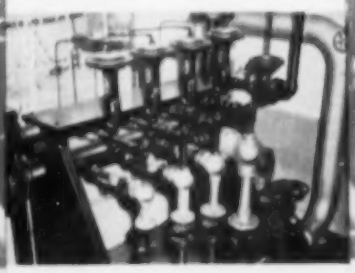
Buying gas without accurate knowledge of the Btu content is "buying blind"... a sure way to pay too much for too little. Selling gas without an accurate knowledge of the Btu content is "selling blind"... and almost always results in supplying *more* value than the contract specifications require "just to be on the safe side." Both practices can undermine profits.

The nation's successful gas transmission companies have proved Btu control is profit control. They avoid the perils of both blind buying and blind selling by using hundreds of Cutler-Hammer Recording Calorimeters. Day in and day out, with *guaranteed* accuracy these dependable instruments reveal and record the Btu content per standard cubic foot... regardless of pressure, temperature and flow variables. Through 35 years they have earned the respect and confidence of users everywhere.

Whatever your interest or requirements may be with regard to gas, you can rely on Cutler-Hammer. Cutler-Hammer Calorimixers and Jet-type Mixers, companions to the Recording Calorimeter, automatically adjust the flow of either high or low pressure gas to maintain constant heating value by Btu "count" and flow control. Both metering and mixing equipment are available for any type of plant and volume of flow. Your inquiry will receive prompt attention. CUTLER-HAMMER, Inc., 1468 St. Paul Ave., Milwaukee 1, Wisconsin.



C-H Calorimixers automatically mix two or more high or low pressure gases of variable heating value in any volume, holding the final product to a constant heating value.



C-H Jet-type mixers automatically mix gases of different heating values to a final low pressure stabilized value. When mixing directly into gas mains as well as into holders, they automatically adjust production to widely varying demands.

THE GREAT GAS TRANSMISSION COMPANIES throughout this nation have standardized on C-H Calorimeters—the only instrument capable of rendering the "count" accuracy required.

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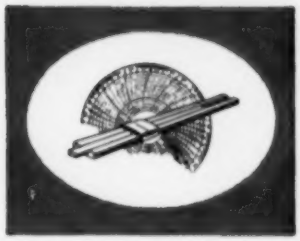
technical trends



By GUY CORFIELD

Spray-can aerosols

Dispensing of materials in aerosol cans has had a fabulous growth and is still rapidly expanding. It started with the DDT, and other insecticidal "bombs" in World War II, and the variety of materials now available include drugs and cosmetics, such as personal deodorants and hair sprays; coatings, such as paints, varnishes, waxes; fire and moth-proofing substances; and whipped cream and shaving cream.

In the space-spray type of aerosol can (or bomb) the liquid propellant dissolves the material to be sprayed. When the valve is opened, the pressure forces the solution out of the can in a spray form, and the propellant instantly vaporizes to leave a dispersion of minute particles of the active material. As the can empties, propellant vapor forms in the top part of the can, but the pressure is maintained as long as there is any liquid left and so the vessel can be completely emptied. A surface coating spray operates in the same manner except that the active material (the paint or enamel) is directed against and adheres to the surface to be coated. For the dispensing of a foam product, the active material (shaving soap, for instance) is partly dissolved and partly emulsified (by shaking) in the propellant, and as the contents issues from the valve the propellant expands to form the tiny bubbles that create the foam.

The surface coating aerosols are not of course, competitive with other methods where large areas or high production are involved, but they do fit in where industry needs a quick and convenient method of applying paints, lubricants and other specialized liquids or powders. In painting, for instance, they are particularly useful where small quantities of paint must be used at intervals; where production volume is too low to justify conventional coating means; where standard equipment, brushes, spray compressors, guns, etc. are not easily accessible or not available; where areas to be coated are not accessible to conventional equipment. Related uses are for fly sprays, disinfectants, small fire extinguishers, stenciling (shipping cartons, pipes, doors, etc.). A recently announced development is an "anti-static" spray for preventing the accumulation of static charges on surfaces, fabrics, clothing, etc.

It would seem that there are many uses for aerosols in gas industry operations. A few that come to mind are to "touch up" meters and meter set piping, and chipped or scraped spots on appliances; for various stenciling or color-code marking throughout the plant; and in general to coat or lubricate hard-to-reach parts of structures or machines. Suppression of static electricity charges might be useful in certain instances. There has been some discussion of a gas odorant masking agent, in an aerosol can dispenser, to be conveniently available when odorant is accidentally spilled.

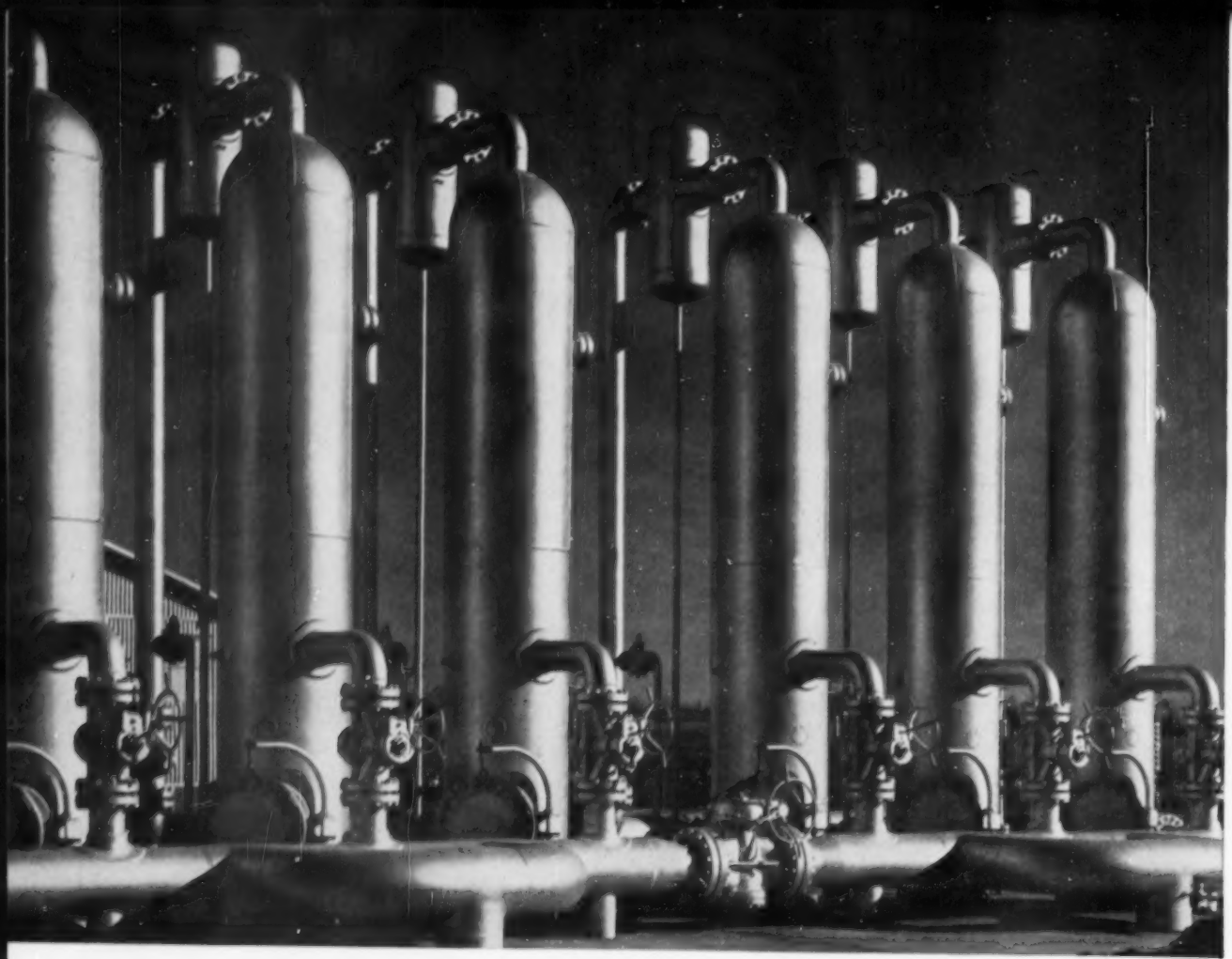
Simplified helium leak detector

The principle of detecting leaks in pressure or vacuum vessels or systems, by pressurizing with helium and exploring for leakage with a suction probe leading to a modified mass spectrometer which will indicate the presence of helium in the sample fed to it, is well known and has been in practical use in industry for several years.

Consolidated Electrodynamics Corp. (formerly Consolidated Engineering Corp.) has recently announced their new Type 24-210 leak detector as a low-cost, portable, easily operated instrument for production-line testing. It is described as a simplified mass spectrometer which responds only to the presence of helium as a tracer gas. By probe or air-sampling methods, it will detect one part of helium in 300,000 parts of air. The presence of helium is indicated quantitatively on a dial, and can also actuate an audible alarm which will tell the operator when the sampling probe approaches or passes over a leak; the pitch of the audible signal varies with the amount of helium entering the leak detector, giving a quantitative estimate of leak rate, and the volume and threshold of the alarm are adjustable.

As a matter of interest to the gas industry, this principle of leak detection is used in the testing of refrigeration apparatus. It also can be used for detecting leaks from gas piping, or direction and path of flow of gas in piping, by adding helium to the gas as a tracer substance. Migration of gas in underground storage projects can also be traced. This Type 24-210 unit weighs 145 lb and is therefore reasonably portable, and usable where electricity is available.

Complete information on the unit can be obtained by writing Consolidated Electrodynamics Corp., 1025 East Green St., Pasadena, Calif., and asking for Bulletin 1830.



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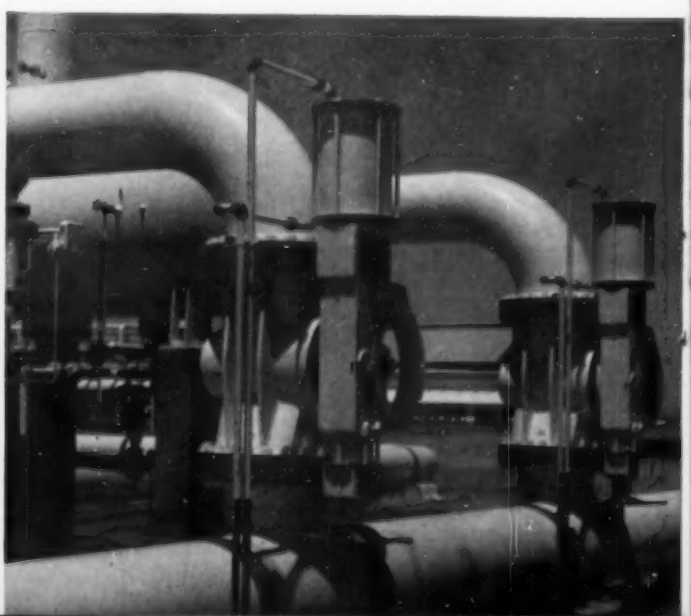

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Rockwell-Nordstrom valves are available in sizes to 34″ and pressures to 10,000 lbs., for gas production, transmission or distribution services. For more information, see your nearest distributor or write: Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.

Canadian Valve Licensee: Peacock Brothers Limited.

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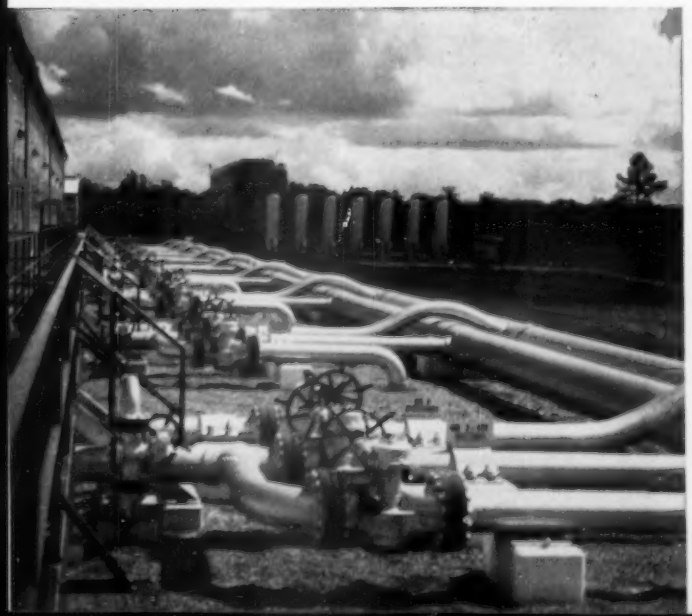
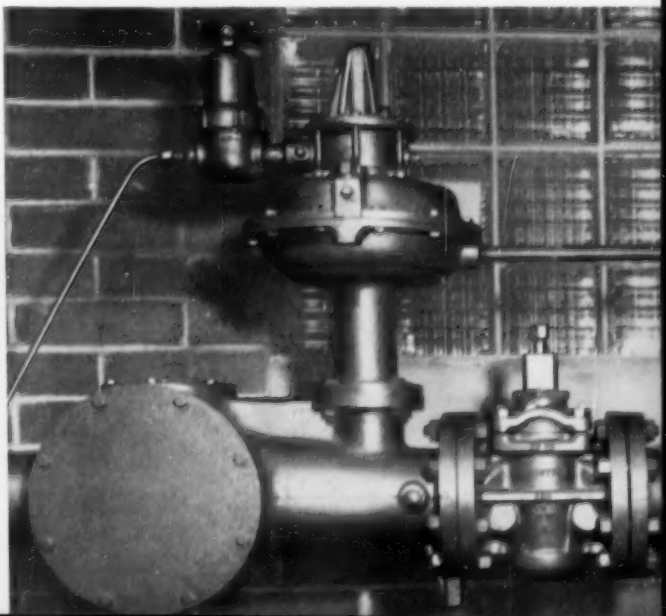
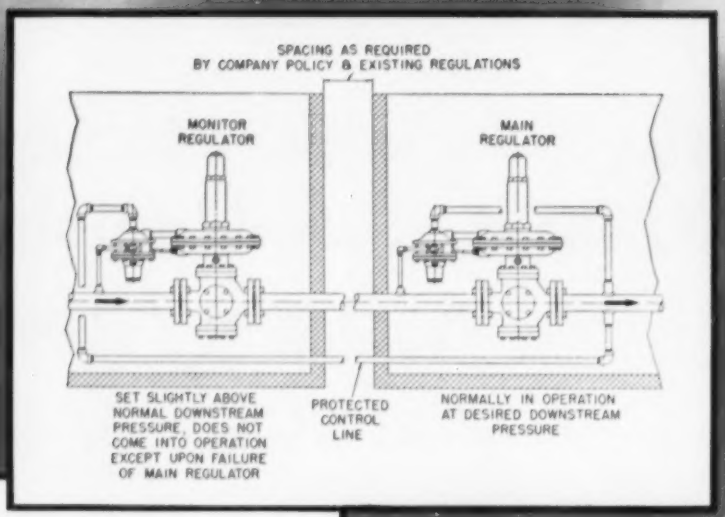




CONFORM to ASA B31.1 CODE

1
FISHER TYPE 298
monitoring or over-ride regulator system.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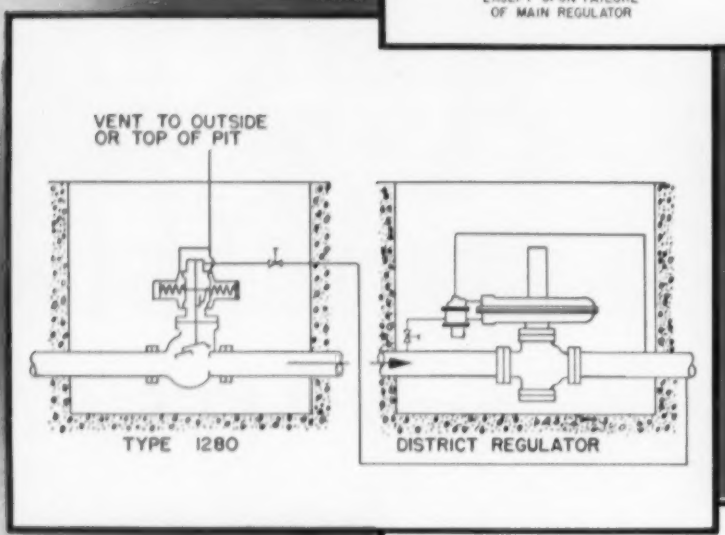
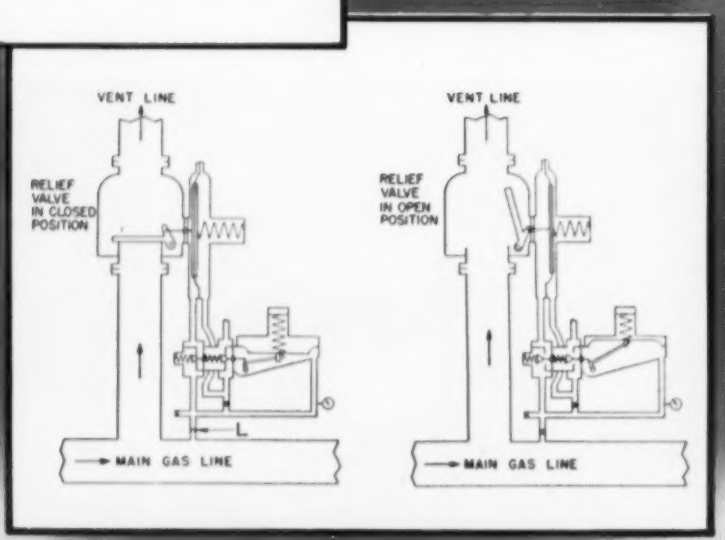
SET SLIGHTLY ABOVE NORMAL DOWNSTREAM PRESSURE, DOES NOT COME INTO OPERATION EXCEPT UPON FAILURE OF MAIN REGULATOR
PROTECTED CONTROL LINE
NORMALLY IN OPERATION AT DESIRED DOWNSTREAM PRESSURE



2
FISHER TYPE 1280
safety shut-off regulator system.

3
FISHER TYPE 29
safety relief valve system.



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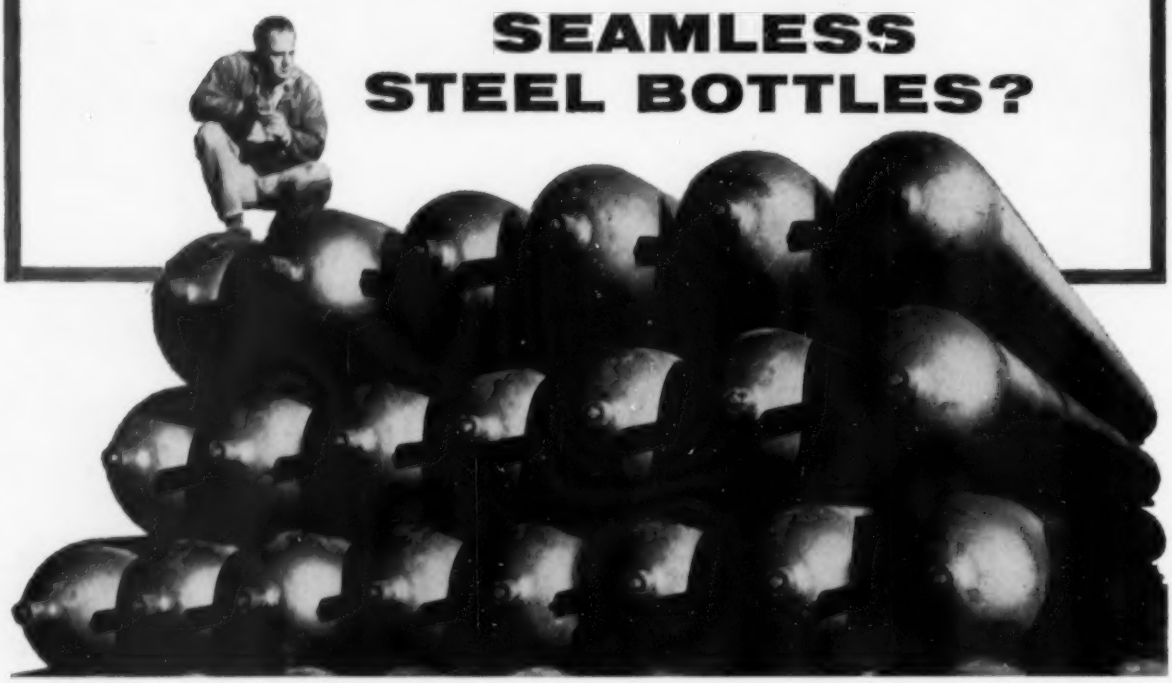
What's so good about underground gas storage in SEAMLESS STEEL BOTTLES?



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Fifty of these Seamless Steel Bottles, each averaging 39 feet in length and 24 inches in diameter, will hold 1¼ *million* cubic feet at 2240 psi. Once installed in the ground, the bottles will not vibrate and settle like a surface installation will. And because underground temperatures are relatively stable the year round, there is little or no fluctuation in gas pressure.

UNDERGROUND GAS STORAGE IS ECONOMICAL

Seamless Steel Bottles call for virtually no maintenance. Unlike aboveground installations, these bottles do not require periodical painting, nor do they need constant inspection against the elements. Moreover, any group of bottles can be taken off the line for inspection or repair at any time without interrupting the gas pressure of the other groups of bottles.

UNDERGROUND GAS STORAGE IS SAFE

Buried underground, National Seamless Steel Bottles are safe from harm. They are effectively protected from storms, high winds and lightning. And there is no hazard to or from aviation.

NATIONAL SEAMLESS STEEL BOTTLES ARE DEPENDABLE

The process of manufacturing National Seamless Steel Bottles assures the utmost in safety, performance and long-time, dependable service. The bottles are pierced from solid billets of high quality steel, leaving little room for doubt where wall strength is concerned. And before being shipped, every bottle is subjected to a high pressure hydrostatic test at the mill.

For more complete details about this modern, economical system of gas storage, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

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UNITED STATES STEEL

No. 5* of 12 REASONS WHY
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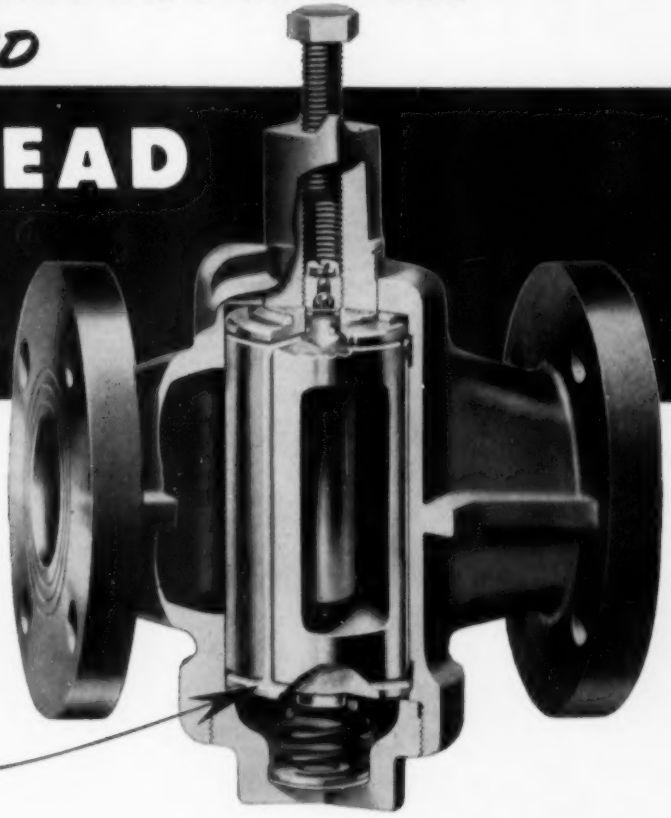
Lubricated
PLUG VALVES



*SELF-FREEING PLUG PREVENTS STICKING

Homestead's exclusive completely controlled lubricant system positively prevents sticking by its instant, piston-like movement of the plug downward at the start of each lubrication. Spring and line pressure return it to stem-sealed position.

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2. Straight line fluid flow—streamlined ports—minimum resistance to flow—minimum pressure drop.
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4. Easy turning—plug floated on Teflon washer and reinforced Teflon ring.
5. Self-freeing plug prevents sticking.
6. Full-threaded screw prevents dirt being forced into lubricant system.
7. Quarter-turn fully opens or closes.
8. Reinforced Teflon stem seal—no cold flow—continuous, positive seal.
9. Seating surfaces protected in both open and closed positions.
10. High pressure lubricant system provides full lubricant seal around ports.
11. Leak-proof double ball and lubricant sealed check valve. No springs. No maintenance.
12. Two lubricants handle most services.

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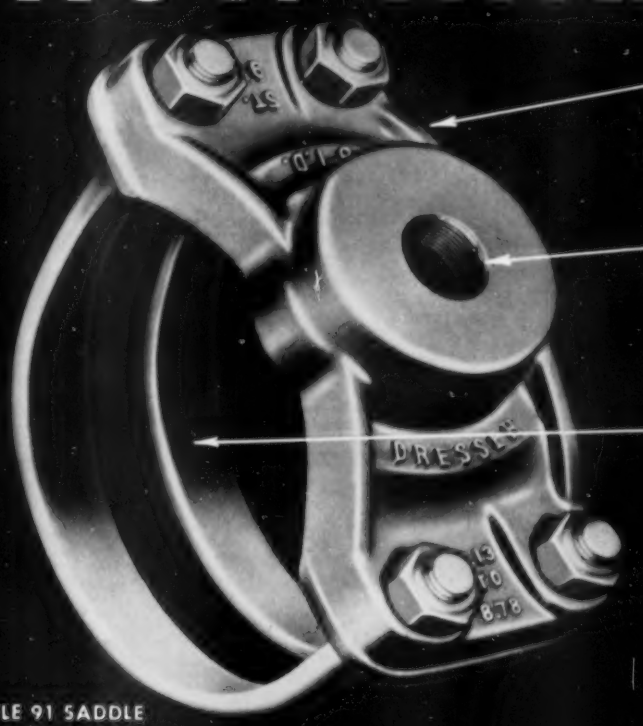

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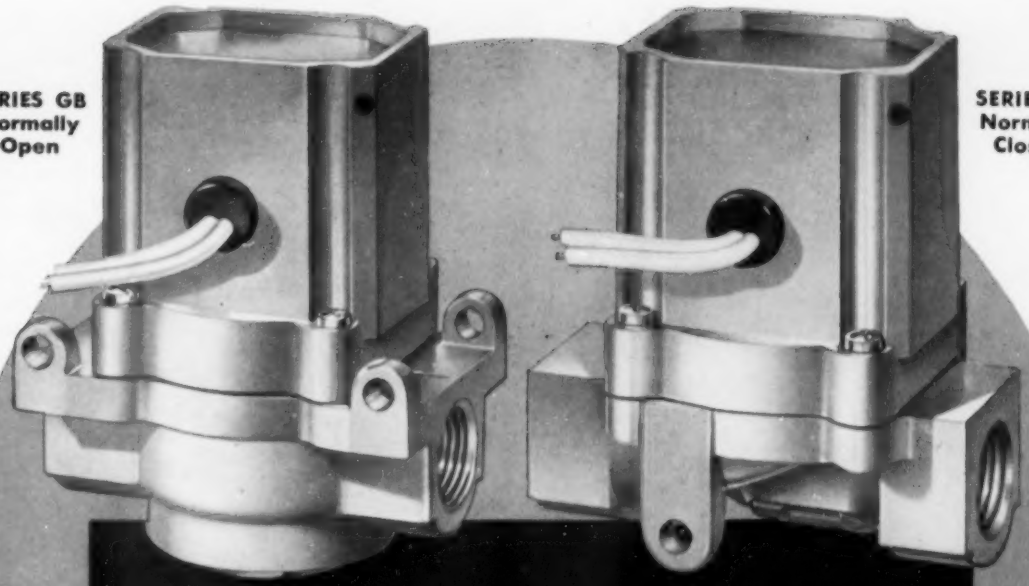

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GAS

AUGUST 1956

Distribution system analysis with the electronic digital computer

By G. G. WILSON, Associate Chemical Engineer,
and
D. V. KNIEBES, Head, Analytical Division,
Institute of Gas Technology, Chicago

GAS exclusive

Fig. 1. The control group of the ALWAC III at the Institute of Gas Technology. At left is the typewriter used to feed in and feed out information, the programming console is in the center, and at right, the oscilloscope.

THE increased availability of natural gas to distribution companies over the last decade has resulted in substantially increased loads on many distribution systems. The sizable investment required to extend and reinforce existing systems has intensified the need for economically sound engineering design of new distribution facilities. Proper engineering design requires an accurate determination of flow distribution in the existing and proposed system. Since this requires long and tedious calculations if manual methods are used, many engineers have hesitated to attempt the problem, and others have found

Distribution analysis . . . A 20-loop trial problem was used to make cost estimates

it difficult to convince management that the results obtained were worth the effort.

Two electrical analog devices which have been developed to enable the engineer to analyze a gas distribution network more rapidly are the Starr linear analyzer[1, 4] and the McIlroy non-linear analyzer.[3, 5] Numerical methods for network analysis have also received attention, and several types of high speed digital computers and punched card accounting machines[6] have been used for the rapid solution of these problems. There is considerable interest, but little experience in the use of digital computers for this purpose as indicated in the Fourth Computer Symposium conducted by *Gas* in 1955.

The Institute of Gas Technology obtained a Starr linear analyzer in 1951 for the purpose of exploring its usefulness in the calculation of flows and pressure drops in gas distribution systems.[4] Since that time, a number of network problems have been successfully solved with this analyzer for gas utility companies.

In April 1955, an ALWAC III digital computer was installed and applied to the institute's complex and more tedious calculations. The possibility of using this computer for network flow problems was apparent and a program was developed for the computer to solve this type of problem by the modfied Hardy Cross method.

The Northern Illinois Gas Co., which had been exploring the use of digital computers for the solution of network flow problems for several years, supplied the institute with a trial 20-loop problem for the purpose of working out time and cost estimates. On the basis of these estimates and a demonstration of the accuracy which could be obtained, Northern Illinois decided to proceed with the analysis of a series of its distribution systems on a contractual basis. Since that time, seven additional problems have been solved for Northern Illinois Gas Co. Five of these problems contained from 30 to 100 loops and each of the other two exceeded 200 loops and 600 pipe sections.

In this presentation, the general procedure developed at the institute for the digital computer solution of network flow problems is described and illustrated by use of a sample problem. The effect of the initial assumption of flow distribution on the final result is observed by comparing the results obtained by starting with two radically different assumptions of the flow distribution, and both of these results are compared with an exact solution. The effect of increased accuracy of the calculated flows on the time requirement for computation is also considered.

Numerical methods

The Hardy Cross method[2] has been used for many years for the numerical solution of network flow problems. This method essentially consists of assuming an initial set of flows in the network so that all loads are met and so that the total flow into each junction equals the total flow out of the junction. A calculation is then made of the algebraic sum of the pressure drops around each loop in the network in the case of low-pressure systems, or of the difference in the squares of the pressures for high-pressure systems. In each loop for which this summation is not zero a flow correction value is calculated and applied to the pipe sections in that loop. This process is repeated for the network as many times as is necessary to bring the entire system into balance.

In the original Hardy Cross method the flow correction values are not applied until they have been calculated for all loops in the network. A modified form of this method applies these values to the pipe sections in each loop as they are obtained, thereby immediately providing improved flow values for pipe sections which are common to subsequent loops. There is evidence to indicate that the modified method converges somewhat faster than the original one.

No mathematical proof of the general convergence of this method is available and some gas distribution engineers have reported indications of lack of convergence in its use. No definite evidence of convergence failure on a practical problem has been offered, however.

Two other methods have been reported by Warga.[7] He presents proof of the convergence of his "Procedure I" and also shows that a Newton-Raphson procedure will converge more rapidly provided that the initial assumption of flows is sufficiently good and that certain other conditions normally satisfied in a practical problem are met.

Since the Warga procedures are quite complex and Hardy Cross appeared to give useful results, the modified form of the Hardy Cross method was selected for use at the Institute.

The computer

The ALWAC III digital computer used for this work is a general purpose computer which can be used for many types of engineering calculations. It is an internally programmed electronic machine whose magnetic drum memory will store 4096 10-digit decimal numbers or their equivalent in instructions. It is considered a medium speed computer and is available from Logistics Research Inc., Redondo Beach, Calif.

Fig. 1 shows the electric typewriter (Flexowriter) which is used as the input-output device, and the control panel, which, in conjunction with the oscilloscope, permits manual control and observation of the information stored in the memory. The institute's computer is shown in *Fig. 2*.

Although the computer operates with binary arithmetic, only decimal numbers are used for input and output since all numbers are automatically converted by the computer. Decimal numbers are read into the computer by means of punched paper tape or by typing directly on the electric typewriter. The paper tape punch or the typewriter is also controlled by the computer to furnish the results of the computations in decimal form.

Distribution analysis . . . One of the first problems solved was the Geneseo system

The program

The series of instructions, which the computer follows to perform the necessary steps in a calculation, is called a program and is stored in the computer's memory. Because of the large amount of time required to prepare a program, it should be sufficiently versatile to handle every problem of the same type. At the same time it should be simple enough in operation so that the data supplied with the problem will require a minimum of preparation before being acceptable to the computer.

The program developed at the institute for ALWAC III to solve network flow problems is a compromise of these two conditions in that some data preparation is necessary for each problem, but almost any practical network containing up to 450 loops and 1200 pipe sections can be solved by the modified Hardy Cross method. Provision has also been made for regulators set at different pressures in the network.

Data preparation

One of the first problems solved for Northern Illinois Gas Co. was its Geneseo system. A scale map of the piping network comprising this system is shown in *Fig. 3*. Before this problem was submitted for solution, the resistance factors [equal to K when the flow equation used is placed in the form $\Delta(P^2) = KQ^n$] for each pipe section were calculated, the magnitude and distribution of the load in the system was estimated, and initial assumptions of the flow rate in each pipe section were made. This information was plotted on a modified map of the system shown in *Fig. 4*.

The modified map is prepared by distorting the loops so that all pipe sections have an east-west or north-south direction and by eliminating sections of line which do not form loops since the gas flow through these sections can be considered to be loads at the point of connection to a loop. Zero resistance pipe sections are sometimes added to the modified map so that triangular loops can be treated as rectangular ones.

Maps are modified in this manner to permit plus and minus signs to be used to indicate direction of gas flow through any pipe section. According to the convention presently used, flow in an east or south direction is considered positive and flow in a west or north drection negative. The sign of the flow value for any pipe section will, therefore, uniquely define direction of flow.

The pipe sections are then designated with a series of numbers which correspond to storage locatons in the memory of the computer. The series of numbers used is quite simple to memorize and little practice is necessary to be able to number the pipe sections as rapidly as could be done with decimal numbers. No particular sequence of pipe sectons is required for the numbering system.

The resistance factors (K) and the initial assumed flow rates (Q) for groups of 32 pipe sections are then tabulated as shown in *Table 1*. These values can then be stored directly into the memory of the computer.

The final step is to prepare a code called the loop code which will permit the computer to associate the proper pipe sections with each loop. *Fig. 4* also shows the form of this code for three loops of the Geneseo network.

Computer operation

The tabulated K and Q values and the loop code are punched on paper tape to provide permanent storage of the data in a form which the computer can read and store rapidly. When the computer has stored this information, a four-letter code is typed on the Flexowriter to initiate computation. The loop code indicates to the computer the proper pipe sections in each loop. The K and Q values for each of these pipe sections are selected from the memory and used to calculate the flow correction value (ΔQ) which is, in turn, used to modify the Q values stored in the memory. This process is repeated on each loop of the problem in the order listed in the loop code. At the completion of each full iteration of the network the computer indicates the state of balance of the problem by printing out: (1) the number of loops which have attained complete balance, (2) the number of loops which have attained a balance within an arbitrarily specified ac-

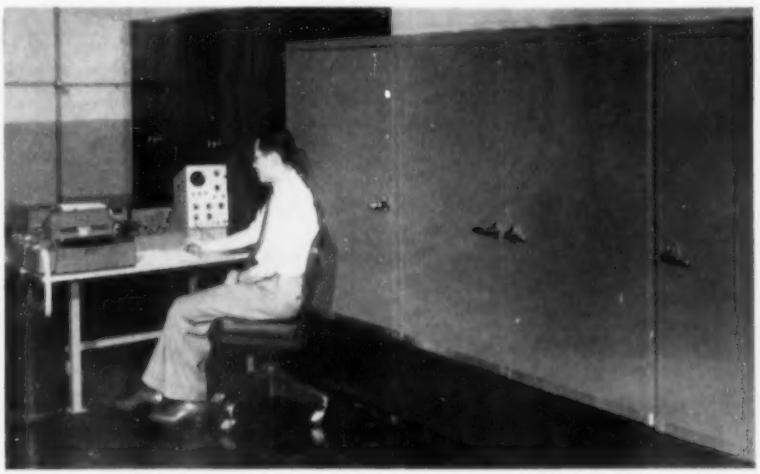

Fig. 2. An overall view of the ALWAC III electronic digital computer at the Institute of Gas Technology in Chicago.

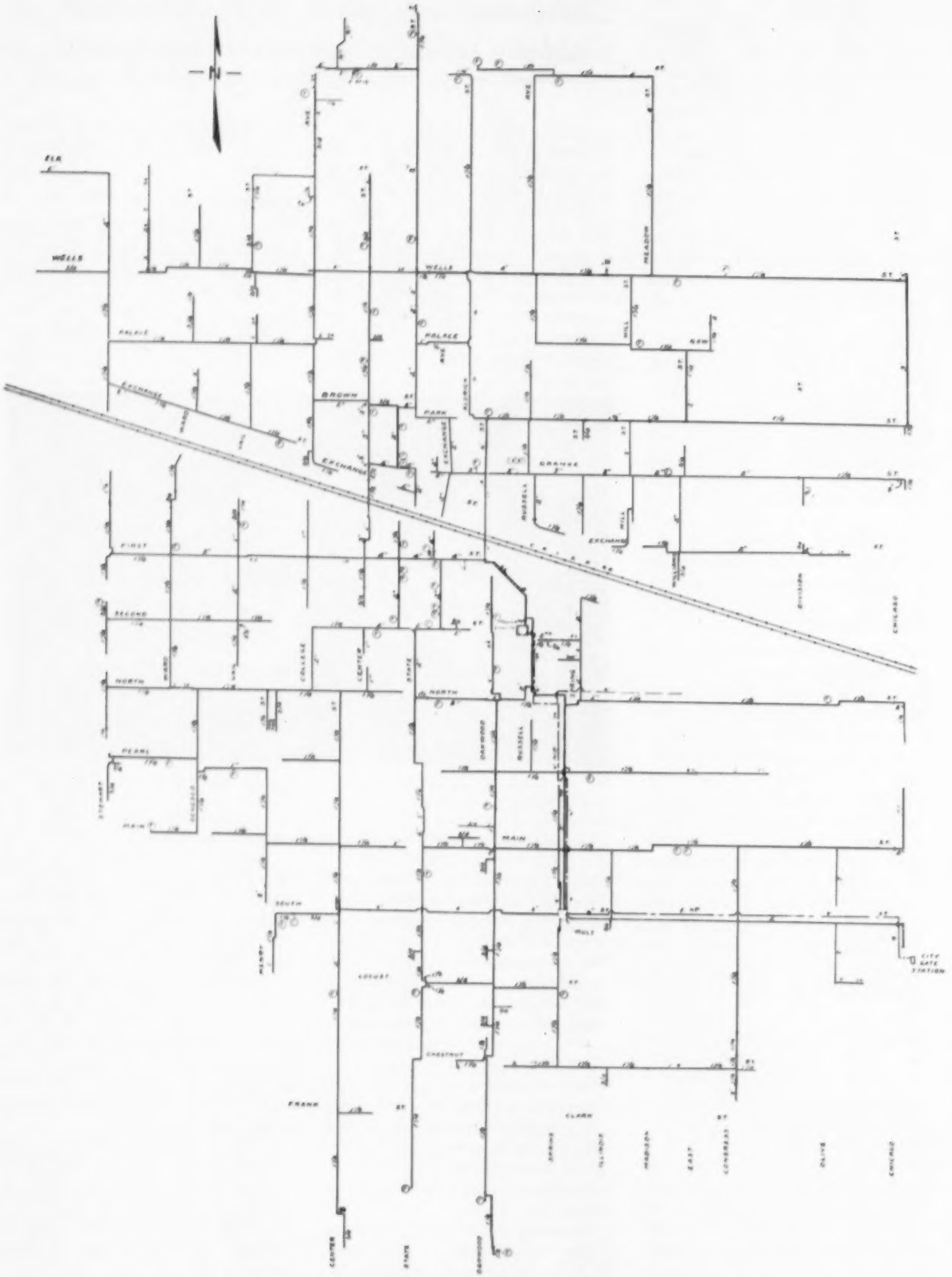

Fig. 3. Finder map of Northern Illinois Gas Co.'s Geneseo system.

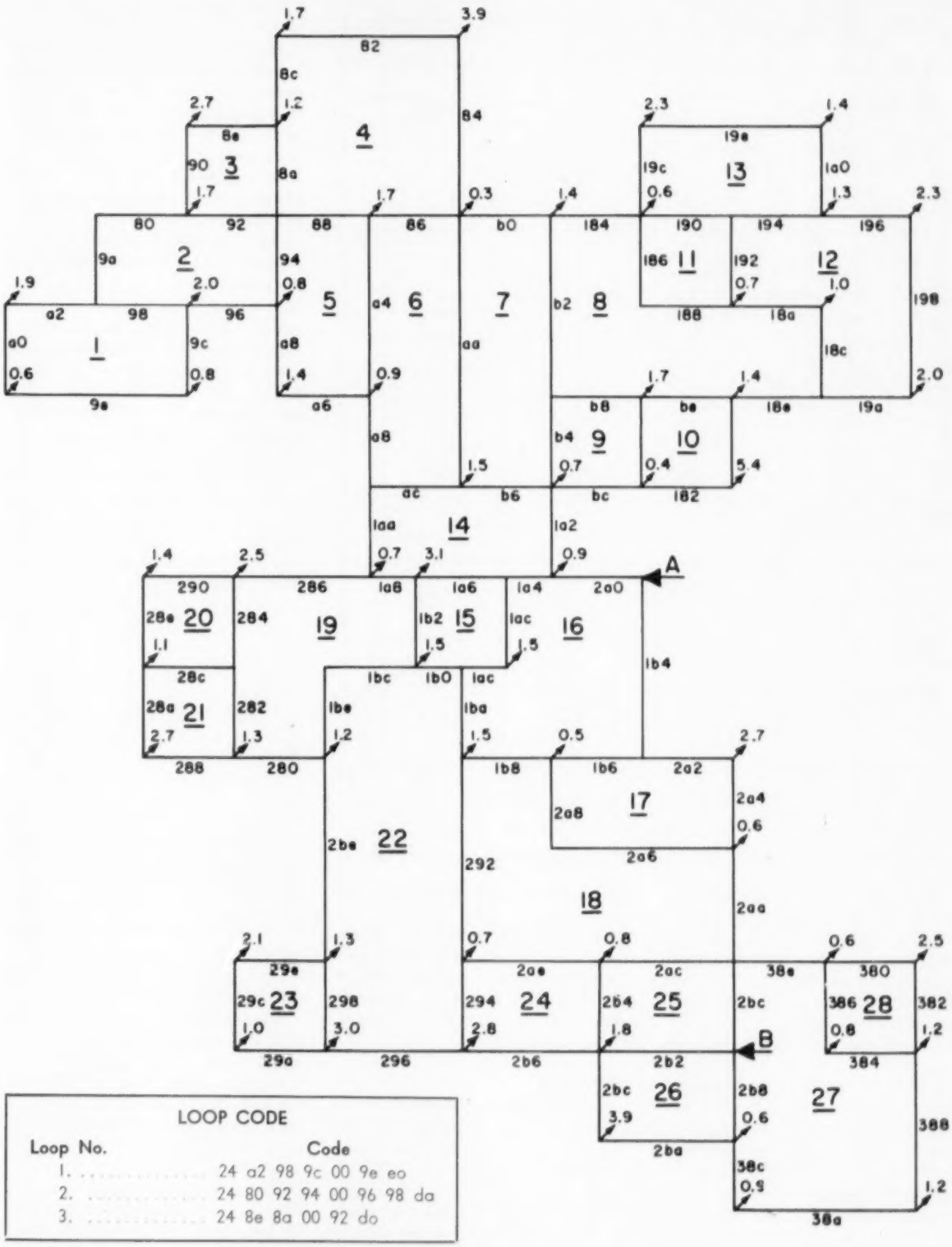

Fig. 4. Modified map of the Geneseo system of Northern Illinois Gas Co.

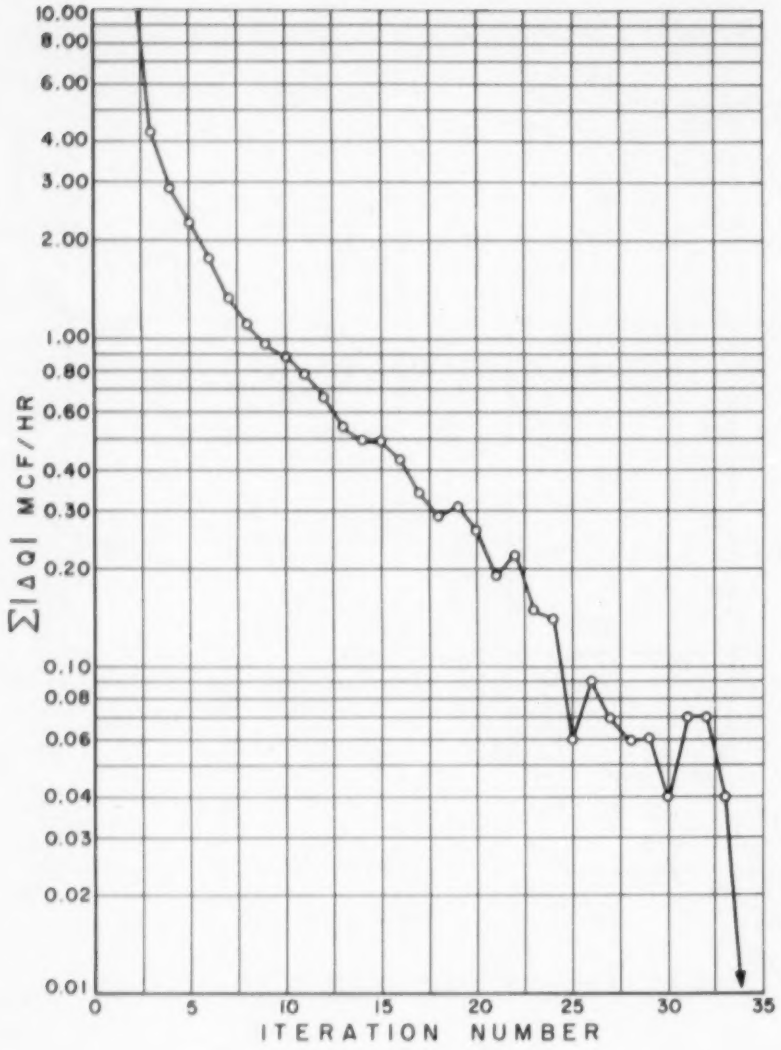

Fig. 5. Rate of convergence plot.

curacy, and (3) the sum of the absolute values of all flow corrections applied during the previous iteration. The computer automatically continues iterating the network until a balance is obtained to an accuracy specified previously and will then stop and indicate that the computation has been completed. At any time, during the computation process, the operator has the option of printing out the flow correction value applied to each loop in the problem and, if he feels it advisable, small sections of the problem which may be somewhat slow in converging can be iterated separately. In this manner the progress of the calculation can be observed in detail or the computer can be left unattended to complete the calculation.

When the desired balance is obtained, the correct flow values are read from the memory and another short program is used to calculate and print out the $\Delta(P^2)$ values for each pipe section.

Results

Some of the results obtained by solution of the Geneseo system, using the good and the poor initial flow assumptions tabulated in *Table 1*, are shown in *Table 2*. The good set of initial flow assumptions were the ones submitted by the Northern Illinois Gas Co. and are probably representative of the accuracy which an experienced distribution engineer could provide for his system; whereas, the poor assumptions should represent the worst values which would be anticipated.

An accurate set of values (*Table 2*) was obtained by balancing the network to the nearest cfh and rounding back to hundredths of an Mcfh. When solved by this method, both sets of initial flow assumptions produced identical results. Checks of pressure drops from each regulator to several points in the system showed that the accuracy exceeded that required for practical purposes.

Solution I (good assumptions) and Solution II (poor assumptions) were obtained by balancing the network to the nearest 10 cfh (0.01 Mcfh). A comparison of these two sets of results shows a maximum deviation of 0.05 Mcfh from the accurate value. It is evident that both solutions were approaching the correct values as balance of the network was obtained to greater accuracies.

Time requirements

The number of man hours required to solve the Geneseo problem is shown in *Table 3*. The computer required two minutes, 15 seconds to complete each iteration. A total of 26 iterations were required to balance the problem to 0.01 Mcfh in the case of the good initial flow assumptions; whereas, 31 iterations were required for an equivalent solution starting with the poor initial flows. No time has been included for correction of errors since it would depend entirely upon the type of error committed. Much of the work can be done by a trained technician, although an experienced distribution engineer should be available for general supervision.

An estimate of overall computer time can be obtained by allowing about six seconds per loop per iteration plus about one minute per group of 32 decimal numbers which must be put into or read from the computer at the start and finish of a problem. The number of iterations required to complete the solution to a problem will depend upon its size, type and the accuracy desired. Problems run at the institute have required as few as eight and as many as 40 iterations to obtain

a satisfactory and workable solution.

Modifications of the network can be made quite simply and the time required to obtain a new solution to the problem is only a fraction of that required for the original network, but will depend upon the extent of modification.

Errors

Errors which occur in a problem can be of two types, human errors in preparing the data and computer errors while processing it. Our experience has been typical in that the vast majority of errors are human. These are presently found only by carefully checking the data before introducing it to the computer. Errors which occur in the ALWAC III during computation are largely of the type which the computer will detect immediately and will stop computation. A special test program is run on the computer each morning. If it performs properly with this test, errors will rarely be made the rest of the day.

Both types of errors must be guarded against, however, since a significant amount of time can be lost in correcting them after a solution has been obtained. For this reason several possible methods of automatic error detection have been considered which would permit the computer to check the accuracy of the loop code and junction flows at any desired time. However, further experience must be acquired to determine the optimum amount of data checking required to provide an accurate solution with minimum cost.

Convergence

The Hardy Cross method has received much criticism because of its apparent lack of convergence. We feel that the basis of this criticism is the fact that after several iterations of a network, the flow correction values will often become larger than those in the previous iteration, thereby giving the impression that divergence is beginning to occur. This situation can be very discouraging if tedious manual methods are being used and it is understandable that an engineer would stop at that point and feel that the method is unsatisfactory. Experience at IGT indicates that it is damped oscillation and not continuous divergence that is being observed in these cases.

Distribution analysis . . . Computer accuracy exceeded that needed for practical purposes

Although the number of network problems solved at IGT with the modified Hardy Cross method is still limited, they have represented a sufficient variety of types and sizes to furnish a significant amount of information as to oscillation and convergence tendencies of the method. Loops having both high-flow, low resistance legs and low-flow, high resistance legs will have the greatest tendency to oscillate. The greater the number of this type of loop in a network the greater the probability will be that it will have a sufficient number of oscillations to significantly retard the rate of convergence. The number of iterations necessary for a solution is also affected by the number of loops in the system, the accuracy of the original flow assumptions and the accuracy required for satisfactory balance. Some moderate and small size networks will require only five or six iterations to produce a balance to the nearest 0.1 Mcf/hr where flow rates vary from 0.1 to about 30.0 Mcf/hr in the network. However, when more accurate flows are required and oscillation is present, the total number of iterations can be much higher.

The convergence rate and oscillation characteristics of the solution of a 43-loop network containing 10 regulators is shown in *Fig. 5*. The degree of convergence is measured by the sum of the absolute flow cor-

TABLE I: TABULATION OF K AND INITIAL Q VALUES

Leg Number	K x 10⁶	Q (Mcf/hr) Good Assumptions	Q (Mcf/hr) Poor Assumptions
180	1240.00	—2.40	—5.70
182	282.00	7.50	10.80
184	48.02	10.60	7.30
186	13950.00	0.00	2.00
188	20900.00	0.00	2.00
18a	11000.00	0.00	4.00
18c	8780.00	—1.00	3.00
18e	11000.00	1.00	4.30
190	61.74	7.70	4.00
192	13650.00	0.70	2.70
194	17.64	7.00	1.30
196	44000.00	4.30	—3.00
198	408.00	2.00	—5.30
19a	43360.00	0.00	7.30
19c	37700.00	—2.30	—0.70
19e	18000.00	0.00	—1.60
1a0	31160.00	—1.40	—3.00
1a2	6.38	—44.10	—45.40
1a4	33.30	—19.80	—18.00
1a6	27.44	—17.50	—18.50
1a8	20.58	—12.20	—11.70
1aa	3833.00	—1.30	0.00
1ac	1600.00	2.30	—0.50
1ae	610.00	—0.80	2.00
1b0	442.00	0.70	0.00
1b2	1600.00	2.20	3.70
1b4	1564.00	5.30	7.00
1b6	6080.00	—1.00	—2.00
1b8	1972.00	0.00	1.00
1ba	1564.00	1.50	—2.00
1bc	12600.00	0.00	—2.20
1be	1.00	0.00	2.20

TABLE 2: COMPARISON OF A PORTION OF THE RESULTS OBTAINED FOR THE GENESEO PROBLEM

Leg No.	Q, Mfc/hr Solution I	Q, Mfc/hr Solution II	Q, Mfc/hr Accurate Solution	KQ^2 Solution I	KQ^2 Solution II	KQ^2 Accurate Solution
180	—2.32	—2.38	—2.35	—6.67	—7.02	—6.82
182	7.42	7.48	7.45	15.52	15.77	15.63
184	9.94	9.89	9.92	4.74	4.69	4.72
186	0.83	0.82	0.82	9.61	9.37	9.47
188	0.83	0.82	0.82	14.39	14.05	14.19
18a	1.38	1.34	1.36	20.94	19.75	20.44
18c	0.38	0.34	0.36	1.26	1.01	1.16
18e	1.66	1.71	1.68	30.31	32.16	31.12
190	6.71	6.68	6.70	2.77	2.75	2.77
192	1.25	1.22	1.24	21.32	20.31	20.95
194	5.46	5.46	5.46	0.52	0.52	0.53
196	2.26	2.25	2.26	224.73	222.75	223.74
198	—0.04	—0.05	—0.05	—0.00	—0.00	—0.00
19a	2.04	2.05	2.05	180.44	182.22	181.33
19c	—1.80	—1.79	—1.79	—122.14	—120.79	—121.33
19e	—0.50	—0.51	—0.51	—4.50	—4.68	—4.61
1a0	—1.90	—1.91	—1.91	—112.48	—113.67	—113.20
1a2	—43.32	—43.32	—43.30	—11.96	—11.96	—11.96
1a4	—20.10	—20.13	—20.08	—13.45	—13.49	—13.43
1a6	—17.27	—17.29	—17.26	—8.18	—8.20	—8.18
1a8	—12.26	—12.28	—12.27	—3.09	—3.10	—3.10
1aa	—2.08	—2.08	—2.10	—16.58	—16.58	—16.86
1ac	2.83	2.84	2.82	12.81	12.90	12.73
1ae	—1.33	—1.34	—1.32	—1.07	—1.09	—1.06
1b0	—0.47	—0.49	—0.50	—0.09	—0.10	—0.11
1b2	1.91	1.91	1.89	5.83	5.83	5.72
1b4	4.35	4.35	4.31	29.59	29.59	29.00
1b6	—1.19	—1.20	—1.21	—8.60	—8.75	—8.90
1b8	0.06	0.05	0.03	0.00	0.00	0.00
1ba	0.86	0.85	0.82	1.15	1.12	1.05
1bc	—0.88	—0.90	—0.89	—9.75	—10.20	—10.07
1be	0.88	0.90	0.89	0.00	0.00	0.00

rection values (ΔQ's) applied to all loops and regulator connection paths during an iteration. These sum are plotted against the iteration number. The network was balanced to flow values accurate to 0.01 Mcf/hr in 33 iterations. Half this number of iterations were required to bring the problem to a point where flows in 30 loops were accurate to 0.01 Mcf/hr and the remaining flows were accurate to about 0.03 Mcf/hr. Time requirements for the computer on this problem were six minutes and 15 seconds per iteration.

Conclusions

Our experience to date has demonstrated that an electronic digital computer can solve gas distribution system flow problems economically by use of the modified Hardy Cross method. Solutions to these problems are accurate and appear to be independent of the original assumed flow distribution in the networks. We feel that with further study, improvements can be made in the convergence rate and oscillation tendencies can be reduced without loss of accuracy. The institute plans to continue work with the Hardy Cross and possibly other numerical methods and hopes in the future to provide a competent evaluation of this technique for its practical use in the gas industry. ■

TABLE 3: TIME REQUIREMENTS FOR ANALYSIS OF GENESEO NETWORK

	Man Hours
Prepare map and number legs	2 hrs, 15 minutes
Tabulate K's and Q's	30 minutes
Prepare loop code	1 hr
Punch data on tape and store in ALWAC	1 hr, 30 minutes
Computer calculation (26 iterations at 2¼ minutes each)	1 hr
Print out flows and pressure drops.	10 minutes
Check and plot results on map.	3 hrs
Total time—9 hrs, 25 minutes	

Acknowledgment

The authors wish to thank the Northern Illinois Gas Co. for granting permission to use the data pertaining to the Geneseo system.

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Construction crew lays pipe near south end of Portland Gas' new perimeter system in hills above West Linn. Side-boom tractor is bending 10-in pipe. Willamette River can be seen in background.

Portland utility expands system to distribute natural gas

PORTLAND Gas & Coke Co. is spending more than $5.6 million this year to expand its distribution system for natural gas, due this month, and the heart of this program is an entirely new pattern of feeder mains for the metropolitan Portland area which now boasts more than 700,000 residents.

This is part of a construction outlay estimated at more than $20 million for a five-year period, which is expected to bring a five-fold increase in volume of gas sales. Making possible the huge growth in gas consumption will be savings of one-fourth or more below present costs for space heating under new reduced schedules, and availability for the first time of large amounts of low-priced gas for industry.

In the 83 communities Portland Gas now serves in northwestern Oregon and on the southwest border of Washington, it has 81,000 customers who used nearly 48 million therms last year. By 1960 the company expects to be selling 200 million therms a year to 110,000 customers.

Already the Portland utility has contracts or is concluding contracts for sale of 100 million therms a year to industries alone, on an interruptible basis, which equals the goal originally set for the fifth year. This gas will average just a shade more than 3.1 cents per therm in price. Contracts are being negotiated for firm gas with numerous smaller industries and commercial firms, at higher figures.

The first six industrial plants signed for major quantities of interruptible gas require extensive big-diameter main construction. At the same time these new mains will be key segments of a new perimeter distribution system that will tremendously augment the present hub-and-spokes system.

The new system of large feeder mains, along with several shorter links to provide short cuts from

GAS exclusive

Reflector signs like this one in foreground have been placed on all construction projects for Portland Gas. Here crew lays 16-in. pipe in Linnton, between pipeline gate station and company's present gas manufacturing plant.

them to strategic points on the present system, will cost about $2.4 million. It will strengthen a metropolitan system that had become so outgrown the company was forced to invoke a ban on additional heating customers in most of its service districts. This freeze, which also affected all districts outside the metropolitan area, was ordered nine years ago, and only this spring was entirely lifted.

Natural gas will flow into the Portland utility's mains at the northwest corner of the city through a gate station which Pacific Northwest Pipeline Corp. will erect on the Oregon side of the Columbia river, connected by a spur line crossing the river from the main pipeline near Vancouver, Wash.

PG&C is building a 16-in. main from that point to its oil gas-making plant in the same corner of the city. Contractors also are at work on two 16-in. mains which will fork out from the plant's mixing and primary regulator station at right angles along the north and west perimeters of the city.

The eastbound feeder main will step down to 12-in., then 10-in. pipe in its nearly 11-mile path, which extends almost to Parkrose, a suburb at the northeast corner of Portland. At that point the first large new industry to come to the area on the promise of natural gas, Owens-Illinois Glass Co., will be a major new industrial customer for a container factory.

The 12-mile westside feeder main will travel almost entirely in fast-building suburban areas, swinging west of suburbs Beaverton and Tigard on its southward route. This 16-in. line will be capped temporarily a few miles southwest of Portland, to be extended in the next few years as an addition to the company's present line up the Willamette valley, serving Salem, Albany, Corvallis and Lebanon, as much as 75 miles to the south.

To take off southeastward from the end of this westside main will be a 16-mile line to Oregon City and West Linn. This 10-in. pipe will primarily transport natural gas to two large paper mills, operated by Crown Zellerbach Corp. and Publishers Paper Co., which together have signed up for more than 130,000 therms a day.

This new line will reverse the present flow of gas through a 6-in. main on a bridge crossing the Willamette river at Oregon City, and will put natural gas into the present service grid of that community as well as reversing the supply northward again toward the Portland city limits through rapidly growing residential areas.

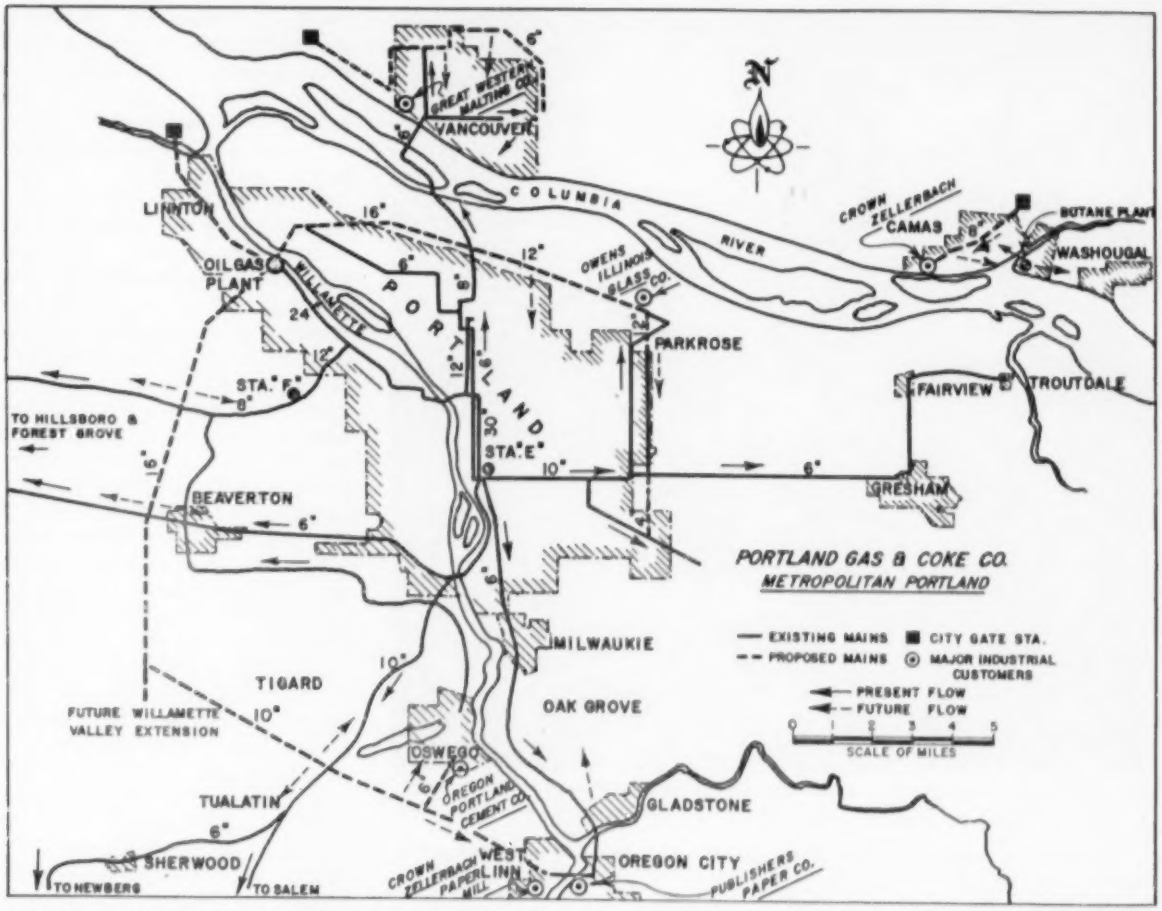
On the north side of the Columbia river, a nine-mile belt line has been laid around the north perimeter of Vancouver, Wash., which is served by the Oregon gas utility. Vancouver will receive natural gas through a separate gate station from Pacific Northwest Pipeline.

Portland Gas & Coke has acquired the 30-mile distribution system in Camas and adjoining Washougal in a stock exchange for United Gas Corp., for 21 years operator of the butane utility. This is the first major extension of territory for the Portland utility in nearly 30 years. The Vancouver and Camas grids will be tied together with a new line in the next few years.

The company expects to put nearly $500,000 into its own three gate stations and in the mixing plant at the present Linnton generator plant. The present oil gas operation will be continued as a peaking aid after natural gas arrives.

Present planning counts on this operation for as much as 2600 MMcf annually. By gasifying straight run fuel oil into 1000-Btu gas matching the natural gas, the plant can pump up to 30 MMcf a day into the lines.

The heavy oil normally used yields 16 to 18 MMcf a day, with considerably more by-products, a



Metropolitan Portland system of feeder mains in operation by Portland Gas & Coke Co. is outlined on this map. Solid lines show present mains, broken lines the new mains now being laid. Oil gas has been manufactured at Linnton and pumped to Station E. Station F, in west hills, assists in supplying area. Solid arrows indicate flow in present hub and spoke system. Broken arrows indicate inward flow from new perimeter mains. Numerals indicate diameter of pipe being installed or already in system.

sideline which the Portland company has built into nearly one-fourth of its total sales and which it plans to continue.

The present distribution system like Topsy "just growed" with the 97-year-old gas utility business in Portland. Feeder mains pushed out from the original plant site on the west bank of the Willamette river near what is now the city center. In the early days gas was manufactured from coal brought in as ballast in ships from Australia, but the plant was converted to oil in 1906.

In 1913 a larger oil gas generating plant was constructed on an entirely new river front site at Linnton, then a separate community seven miles northwest of city center. But service distribution from the center of the city was retained, even to the St. Johns and North Portland districts across the Willamette from the plant.

The centralized distributing system was strengthened in 1920 with construction of Station E on the east side, which was expanded to pump gas 75 miles up the Willamette valley when the company entered that territory in 1929 and 1930.

The new perimeter mains will supplement and not replace the present Station E scheme, which pumps gas outward as from a hub. Station E still will supply gas to the low-pressure central east side, but will have help from a new 12-in. line to bring high pressure gas from the new Columbia Blvd. main down to the far side of the district. With its 30,000 customers, the central east side is the company's largest service district.

The hub-and-spoke system already has been receiving some perimeter-type assistance. Station F, a booster and butane mixing unit, was built in the west hills just outside the city in 1946 to augment the gas supply primarily to Tualatin valley communities west of Portland. This station probably will be discontinued after 1958.

During peak-load periods, butane mixing stations also are operated at Vancouver, and at Salem and a point between Albany and Corvallis toward the southern end of the company's system.

Four butane stations will remain in service, while those at Vancouver and Camas will be discontinued with arrival of natural gas. PG&C plans to take gas off

Trencher digs ditch at north end of new perimeter system near Vancouver, Wash. Equipment is working on top of a dike in Columbia River. Highway also runs along dike.

SideBoom tractor lowers section of 16-in. pipe into place for new Portland Gas line near Linnton.

the pipeline at 400-lb pressure at its three gate stations, and this will afford sufficient pressure at the Portland station to push the fuel to Salem and points south.

The company is planning to install additional butane facilities able to dilute up to 10 million therms a day in the third year. Cost is estimated to run above $700,000. Butane will be used for peaking, as it is at present, and location of new stations will depend on where the heaviest load-to-line ratios develop.

The Portland Gas system grew piecemeal through the decades, much as a city does, and at no time was the company ready to make the investment necessary to create a model distribution setup.

The new perimeter layout will provide a more ideal system while strengthening rather than replacing the old, by bringing gas around the city and feeding it in toward the center. Not only will it shorten the travel of the gas but also it will reduce the travel of gas inside the city. For instance, the entire valley supply within two years will no longer move through Portland, but west of the city.

By rearranging so that districts will be on ends of lines, sharp reductions in line pressures within the city, now ranging up to 100 lb, will be possible. The present valley line which traverses the south portion of the city from Station E carries a normal pressure of 125 lb, and this will be materially reduced when the new line goes in. Traffic through the city will be minimized.

The Portland utility has sized the new lines to its anticipated fifth-year loads, plus 50%, in the districts the particular lines will serve. The Oregon City-West Linn extension is unusual in that its off-peak load will be heavier than its peak load, because the big industrial accounts are interruptible.

Its engineers expect some problems when natural gas actually flows into the new and old systems, such as unforeseen results from reversal of flows in certain sections. The new lines will greatly facilitate actual conversion by

helping to provide a flow of natural gas from a side opposite to that of the manufactured gas in the 44 conversion districts. A $3-million conversion program will be intensified this fall.

Actual construction of the new feeder mains by a half-dozen contractors has run into highly contrasting conditions. A large portion of the Vancouver line was laid in a flood levee beside a county road. In West Linn and near the Portland gate station the ditching crews ran into hard rock and were forced to resort to jackhammers for hundreds of yards.

The 16-in. west side line will climb over a steep ridge more than 800 ft high, which starts practically across the highway from the present plant. First unusual hurdle was to cross the Willamette river near the plant with a 16-in. line that is part of the Columbia main. The 1700-ft under-water segment was all welded together and encased in 2 in. of concrete, then was dragged into a ditch crossing the river by a team of eight bulldozers.

Portland Gas has purchased 6700 tons of pipe for its own projects since last September, spending about $1.5 million for pipe, fittings and coating material. The pipe was ordered to meet 5LX and 5L specifications of the American Petroleum Institute.

Pipe orders were divided about equally among Kaiser Steel Corp. in California, United States Steel at Lorain, Ohio, and Beall Pipe & Tank Co., Portland. ■

Welders complete tie-in after 1700-ft section of 16-in. main has been dragged into trench crossing Willamette River. Main forms an important part of new perimeter system being constructed by Portland Gas & Coke Co. to expand service. River segment was encased with a 2-in. concrete coating.

Typical pipe-laying scene along Columbia Blvd. line, the north-south perimeter unit.

SoCal modernizes meter shop with electrostatic paint line

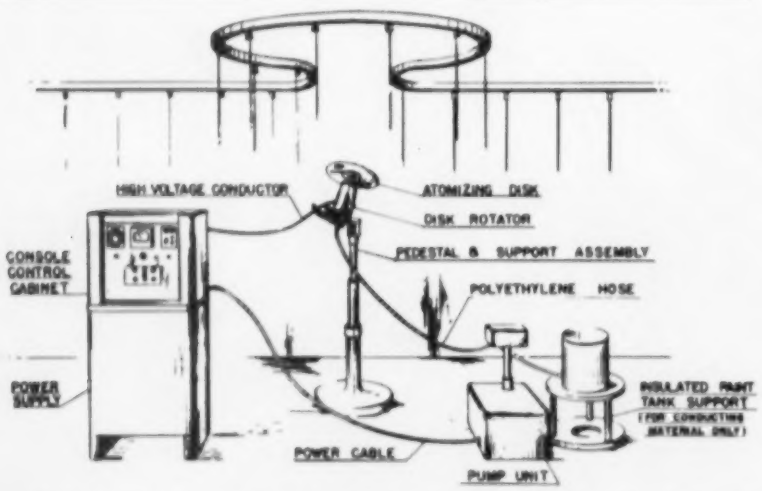
SOUTHERN California Gas Co. has modernized the painting operation in its Los Angeles meter shop by the installation of an automatic electrostatic painting system.

This system has eliminated nearly all of the waste spray that is a common sight in most meter shops relying on manual spray painting methods. It is estimated by SoCal meter shop officials that the new method has 90 to 95% efficiency, as contrasted with 50% waste in the former manual method.

Domestic meters travel through the SoCal shop on a 450-ft Bushman conveyor at a speed of about 3 ft per minute. The conveyor runs through a primer booth, a finish booth, a touch-up booth and a drying oven. The oven is operated at 110°F maximum to avoid the effect of excess heat on oils and lubricants within the meter. Meters are spaced 2 ft apart on the conveyor. An individual meter is on the line for approximately 2.5 hr.

Painting is done automatically by an electrostatic process. Paint or primer is pumped from a storage barrel to a tilted disc in the paint booth (*Fig. 1*). The disc is charged with 90,000 volts of 5 milliamp current. The electric charge atomizes the paint. The paint is then spun off the disc, which revolves at 900 rpm, to the meters which are grounded on the conveyor. The positive charged paint is attracted to the grounded meter of opposite polarity.

The meters rotate at a speed of two to three revolutions per foot while they are moving through the paint enclosures.



A schematic view of the tilting disc installation. Meter travels from left to right by overhead conveyor.

After the meter receives the primer coat, it goes to a completely automatic, gas-fired oven (*Fig. 2*), where it is dried for 10 minutes. From here, it goes to the finisa booth. (*Fig. 3*). Then the conveyor carries it to the finish booth (*Fig. 4*), then back to the oven for two hours.

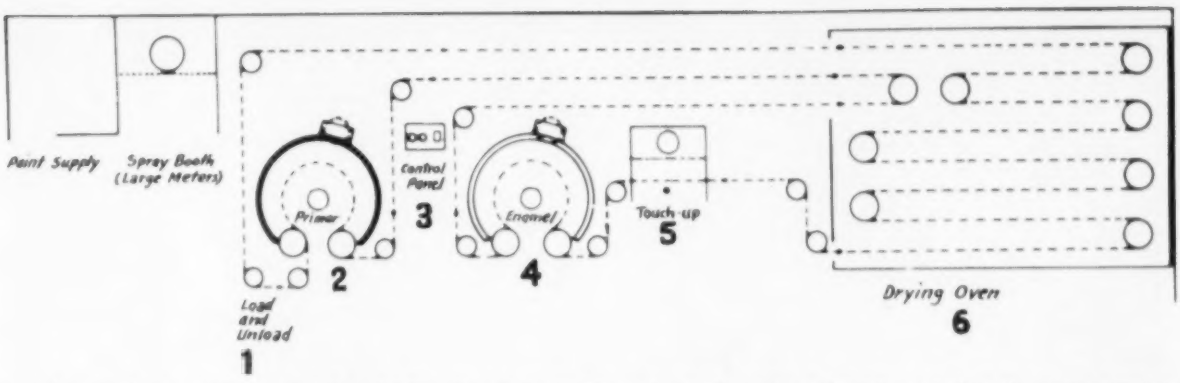
This electrostatic paint line at SoCal is patterned after somewhat similar installations in the shops of Rockwell Manufacturing Co. and Public Service Co. of New Jersey.

The electrostatic painting equipment, including the transformer, is leased by SoCal from the Randsburg Electro-Coating Corp. The paint booths and oven were made to SoCal specifications by the William A. Vensel Co.

The entire paint line is operated by one man. This operator masks the index glasses with an adhesive, loads the conveyor, stencils the year of repair on each meter, and unloads the painted meters when they have finished their tour of the paint line. Formerly, three men were required to handle the painting operations.

Normally, about 700 domestic meters are painted in a day, using an average of 7 to 8 gal. of primer and 12 to 13 gal. of finish coat paint. When necessary, over 1000 meters can be processed in an 8-hr period.

An automatic safety system shuts down the entire operation in case of any malfunction along the line. The system will not operate when the doors to the paint booths are open.



A schematic drawing of the electrostatic paint line. No. 1 is the loading and unloading point, 2 the primer booth, 3 the control panel, 4 the enamel booth, 5 the touch-up booth, and 6 the drying oven.

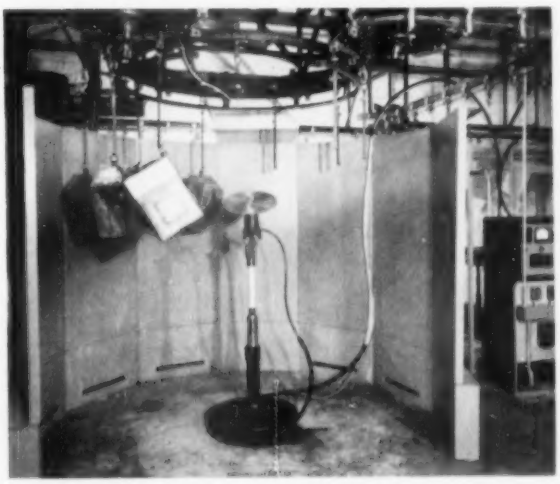


Fig. 1. Meters receive their prime coat in this booth at the SoCal meter shop. Paint is pumped onto the revolving tilted disc (center) and charged with 90,000 volts at 5 milliamp.

Fig. 2. Meters pass through the oven twice on their trip through the paint line. The meters shown entering at right have just come through the touch-up booth at left.

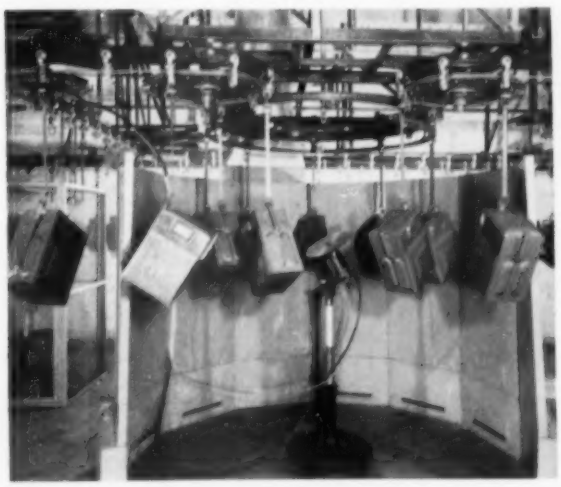


Fig. 3. Meters receive their finish coat of paint in this booth. It is an exact replica of the primer booth.

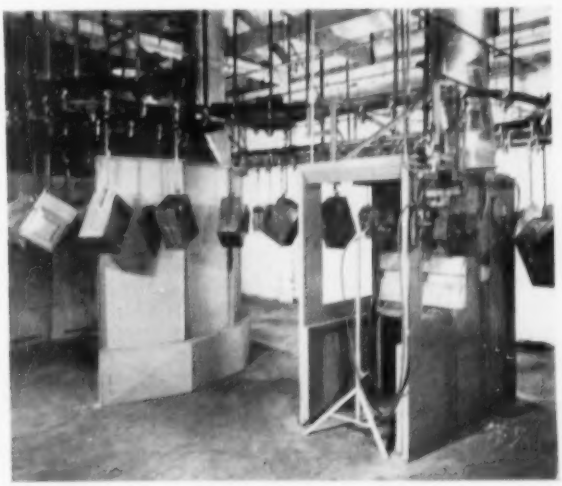
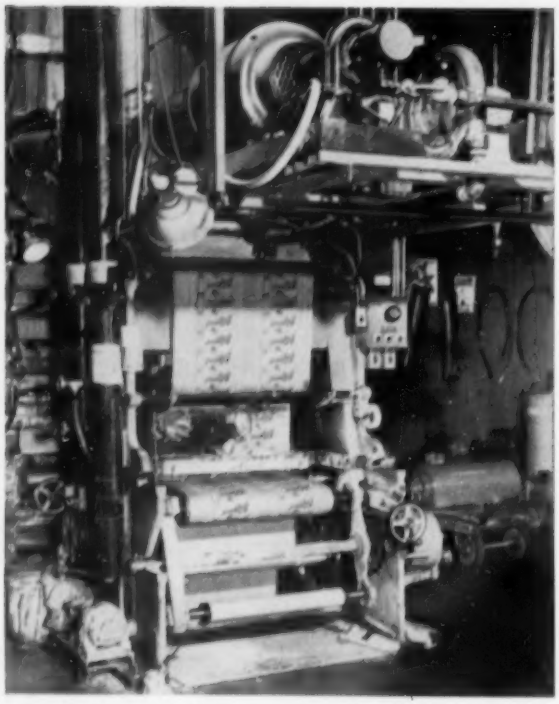


Fig. 4. The final application of paint is applied to the meters at this automatic touch up booth.



A gas fired-external air heater, upper right, is used to dry ink on this six-cooler flexographic type press. Cellophane, polyethylene, pliofilm, paper, foil and Saran wrap also are printed on this press, and require hot air drying.

Gas drying equipment speeds production in Seattle printing plant

IN order to increase production, the Pacific Waxed Paper Co., Seattle, Wash., has installed gas-fired drying equipment on many of its paper processing machines and printing presses. It prints and waxes opaque and sulfide papers for bread wrapping; prints cellophane for specialties and other plastics for the Pacific Coast, Alaskan and Philippine markets. This particular plant is the only one of its kind in the state of Washington.

The most outstanding use of gas in this plant is for the ink drying of cellophane between colors and after final printing. This is done by means of a gas-fired external air heater attached to the flexographic presses. Other materials processed on the flexographic presses requiring hot air drying are polyethylene, pliofilm, paper, foil, Saran wrap and acetate film. On some of the printing presses, ribbon burners have been installed so that the flame comes in contact with the cellophane web to fuse the dried ink to the coating at about 180°F. On these installations the web runs at about 300 ft per minute and there are the usual safeguards to remove the flame should the speed fall below a certain rate or should the web break.

With the addition of gas air heaters for final drying and between color drying, press capacity has been increased several times the former speeds. Regular web cylinder presses, gravure and stereo presses are used for most of the printing operations and steam is used for most of the drying requirements.

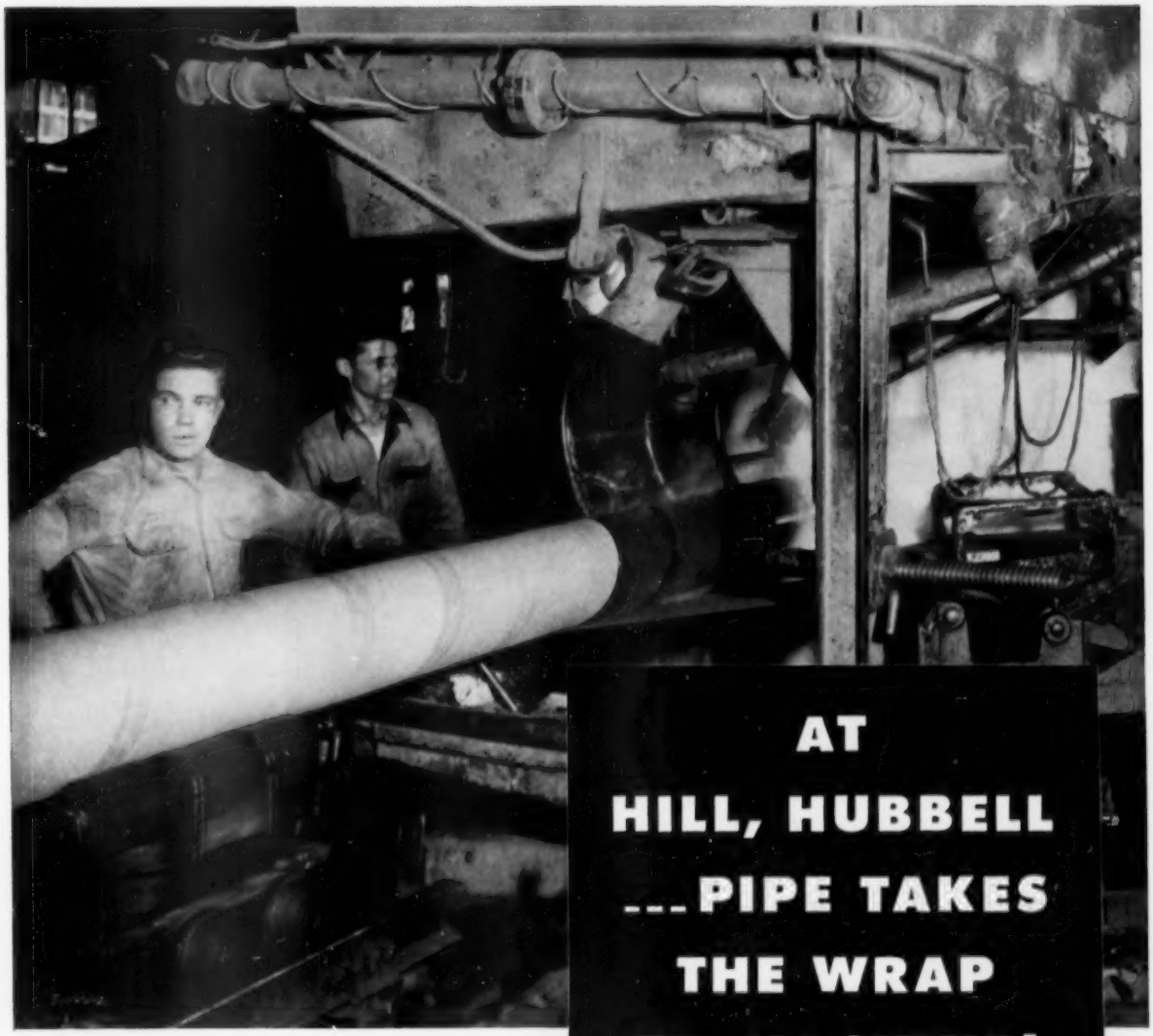
The waxing of paper is a highly specialized operation. The waxes used are polyethylene, micro crystaline and base paraffin. Wax is steam heated to approximately 210°F for use in the coating machines. Transparent paper is double waxed and other papers are waxed to varying degrees depending on ultimate use.

After going through the waxing machines, the wax is chilled by 40° to 50°F water, cooled with brine coils. When the paper has been waxed and cooled it must be stored for curing before being cut to size for the customer.

Another gas application is in the making of printing plate engravings. These engravings are heated over a gas hot plate to melt the etching powder.

All steam requirements are presently met using oil-fired scotch marine boilers, but surveys have been made for converting the boilers when natural gas arrives in late summer 1956. ■

GAS utilization report



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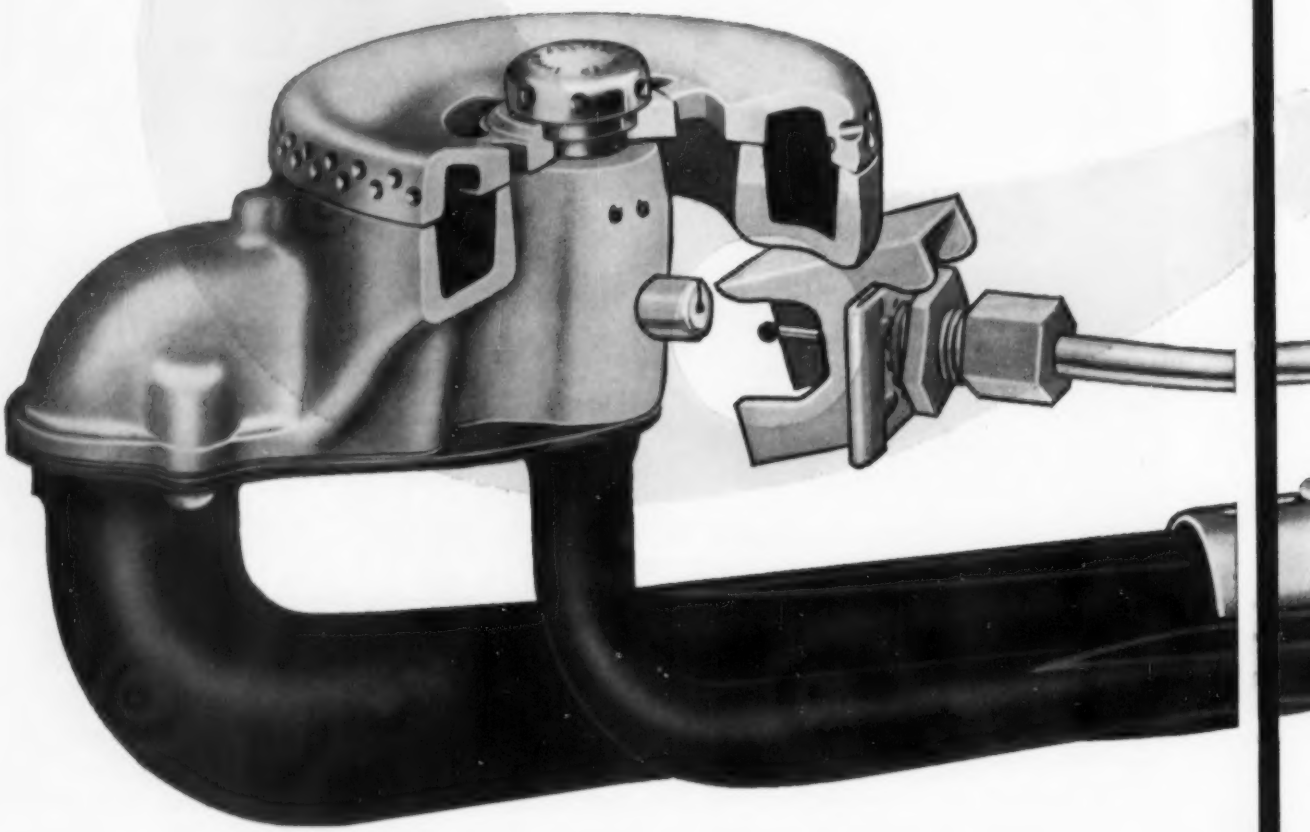

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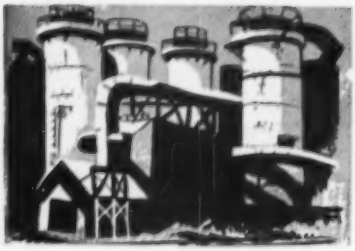

Peoples Natural finds odorization program has paid dividends

By R. W. MILLER, Reseach Director
and
M. D. CRANE, Assistant Research Director
The Peoples Natural Gas Co., Pittsburgh, Pa.

GAS exclusive

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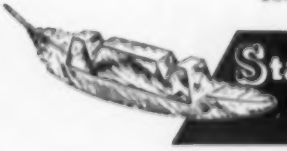

Standard Magnesium Corporation

THE Peoples Natural Gas Co. of Pittsburgh, Pa., serving approximately 241,000 residential, commercial, and industrial consumers with natural gas in western Pennsylvania, completed its odorization program in May 1953*. As three full years of operation have elapsed since that time, ample opportunity appears to have been given for a study of over-all results, so far as the installations themselves are concerned, as well as to secure first-hand information from the distribution system angle. Such experience may prove valuable to organizations planning odorization programs, or to others already having such operations.

Appalachian field natural gas, the principle supply sold for many years by Peoples Natural, had its own distinctive gasoline or petroleum odor. However, with increasing volumes of southwestern natural gas being purchased in recent years, amounting to approximately 70 per cent in 1955, to be mixed with the locally produced gas, the characteristic odor of the latter was reduced so materially that odorization appeared necessary. Immediate system-wide odorization obviously was impossible, and instead at the start, an experimental unit was installed in 1952 at Midland, Pa., where necessary testing work was performed and customer reaction obtained. Following such work, 14 odorizing stations were erected and placed

* GAS, Vol. 29, No. 7 (July 1953), pp. 39-42.

in operation throughout the Peoples system.

A cyclic sulfide odorant is used in those 14 stations, injection rate thereof being 0.75 lb/MMcf. The natural gas so odorized does not have a nauseating odor, but rather approximates the odor once apparent in natural gases from the Appalachian field, an odor well known to the consumers of Peoples, and one which they always have associated with natural gas. The physical properties of the odorant are such as to make its use satisfactory. Some companies using the cyclic sulfide odorant believe a concentration of 0.50 lb/MMcf of gas to be sufficient, while others have gone to a 1-lb rate. Peoples Natural for its particular natural gas needs 0.75 lb/MMcf to insure a threshold odor sufficiently low for its customers to have adequate warning, should a leak develop.

The odorant is handled in drums, shipped to a central warehouse in box cars, and distributed from there as needed to the various odorizing stations. Empty drums are assembled at points of usage, their heads are removed with a Gardner barrel head cutter and then burned out, using a small quantity of kerosine as a starter. At two odorizing stations of an affiliated company selling odorized gas to Peoples, large aboveground storage tanks have been installed (4000 and 1000-gal. capacity) making possible bulk truck delivery of the odorant from point of production. A regulated pressure of 5 psig of natural gas over the odorant is maintained in the storage tanks.

Various types of odorizing equipment have been tried by Peoples in an effort to determine the one or two best suited for its needs. The inherent points of weakness have been studied and, at this time, the company has standardized on (1) a proportioning unit, and (2) a diaphragm-type pump without packing. Piston-type injection pumps were tried, but packing troubles developed. The packing on the piston is itself resistant to the odorant, but will not flow sufficiently to stop leakage. Tightening of the packing

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The 305 digs to 5 feet, 6 inches deep; 12 to 24 inches wide in 2-inch steps. To get all the facts about this advanced ditcher, call your Gar Wood-Buckeye dealer, or write: Customer Service Department, Gar Wood Industries, Inc., Wayne, Michigan.

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can result in scoring the piston rod, which produces additional leakage. This difficulty may be due to the diameter of the piston in small capacity pumps, as with larger pumps having pistons sized 0.5 in. or larger, successful operation has been reported elsewhere.

For unattended locations, the proportioning type of odorizer is used. The Peoples company has housed its units, although an affiliated company in West Virginia, as well as another organization operating in western Pennsylvania, has installed many proportioning odorizers in the open. Any hydrate-forming tendency in the odorizing housing of the unit, which could retard the action of the pump or shear off gears in the driving mechanism, has been obviated by the addition of a small amount of alcohol to the odorant. Such a practice will nullify to a certain extent the odor produced. Earlier models of the proportioning odorizer were prone to leakage due to many connections. Later models, wherein the number of connections has been reduced to a minimum, equipped with packless carbon steel valves and Flex Ring closures on the odorizer housing, have proven leak-proof and less laborious to operate and maintain. A good description of such an odorizer, practically custom-made, was given by George C. Dormer at the AGA chemical, engineering and manufactured gas production conference held in Pittsburgh on May 24-26, 1954.

The proportioning type unit may be selected for a wide variety of operating conditions. Odorant storage tanks from 26 to 250 gal. are available. Daily flow tanks ranging from 1 to 12-gal. capacity are available as accessory equipment. Gauging devices for indicating the liquid level may be of the reflex liquid level type, or of the indirect Magnetron percentage-indicating type. In the Peoples system, the standard size decided upon is an 85-gal. storage tank unit with a daily flow tank of sufficient capacity for the maximum daily odorant requirement. A reflex type liquid level gauge calibrated in pounds of odorant indicates the capacity of the daily flow tank, or the daily flow tank and the storage tank. Use of the direct reading gauge eliminates the necessity of estimating percentages on a dial and of converting readings to pounds of odorant. All units are checked daily to insure proper operation and to obtain liquid level data for odorization reports.

The use of Flex Ring closures on the proportioning mechanism housing has eliminated the laborious task of removing and tightening flange bolts. When a unit is being put back into service after having been de-pressurized for inspection or repairs, very careful attention must be given to the flex ring and its bearing surfaces. They must be scrupulously cleaned of all dirt and of all previous plug grease. A liberal application of uniformly distributed plug grease of the type recommended by the manufacturer will ensure a gas-tight seal when pressure is turned again into the unit.

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nation piston diaphragm pump using oil as a hydraulic linkage to flex the diaphragm alternately forward and backward. The length of piston stroke controls the oil displacement and the volume of diaphragm flexure. The diaphragm alternately admits and discharges a liquid like a conventional piston pump. The length of stroke of the pump may be varied manually at the pump, manually by remote control through a pressure controlled piston, or automatically by a transmitter operating from an orifice meter or pitot tube. The pump is practically leak-free since odorant does not contact a packed piston rod. Diaphragms of stainless steel and of plastic have given equally long satisfactory service.

A complete monthly record is kept at each odorizing station. Daily entries include volume of gas passed in MMcf, pounds of odorant in the daily flow tank at the beginning and end of each day, pounds of odorant added to the gas, and a column for remarks. Totalling the volume of gas and odorant added for the month provides data for calculating the average monthly odorization rate for the station. The original copy of the report is forwarded to the superintendent of distribution each month.

Some 60 testing locations in the Peoples system have been carefully chosen, where quarterly odor tests are run regularly by qualified individuals using and odorimeter, properly calibrated. Threshold tests have been found uniformly low, not closely approaching the so-called 20 per cent level or 1 per cent natural gas concentration, which could prevail if the odorant injection rate were too low. As is well known, all individuals are not equally conscious of strange odors. Low threshold intensity insures, so far as possible, the detection of leaks well below the prescribed limit.

The gas odor leak complaint rate now averages approximately twice the rate experienced previous to odorization. With only limited odorization, the 1952 rate had been 0.6 gas-odor leak complaints per week per 1000 meters. During 1953 when odorization

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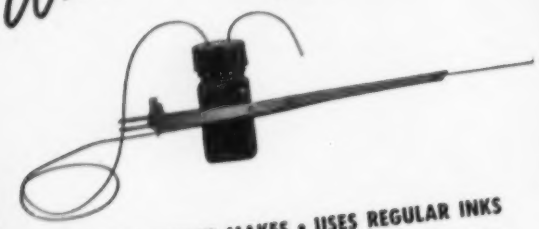

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was being completed over the entire system, the rate climbed to a high of 1.9 odor leak complaints per week for one month. The 1953 average value was 1.4 gas odor leak complaints per week. The rates for 1954 and 1955 were 1.1 and 1.0, respectively.

Customer reaction to the odorization program has been excellent. Nuisance complaints have been very few in number, attesting to no excessive rate of odorant injection. Gas users have been most helpful, sensing as it were, or so it seems, that the imparted odor was for their benefit. Due to proper advance publicity, the populace in general appeared to be prepared for odorized natural gas, were expecting it, approved of the idea, and have learned to rely on its possibilities. Out-of-door workers, when discharging their regular duties, have, from time to time, advised householders of a strange odor in front lawns, along driveways and sidewalks, usually suggesting a telephone call to the gas company office.

Street opening inspection men, bar-testing crews, and excavation gangs hail odorization as a long step forward for them. Pinpointing becomes less difficult, leaks are easier to find, fewer holes need be opened. Even line walkers on their cross-country chores are using an added facility, the sense of smell. Many small leaks in high pressure transmission lines carrying odorized gas have been discovered by odor detection, the leak itself being too small to be noticed in the usual manner.

To summarize briefly, it can be said for The Peoples Natural Gas Co. that its odorization program to date has proven itself and, based on experience, it has been well worth while. ■

Continued from page 12

whenever a state allows such costs.

"Under the existing practice of the Bureau of Public Roads, federal funds may participate in utility relocation costs to the same extent as other construction costs without any percentage limitation based on the state's apportionment.

"In adopting the House language, the conference agreement intends that the section will be applicable to the amount paid by the state."

This new legislation is a great victory for justice to utilities. With the declared Congressional intent that the federal government "assume its proportionate share of utility relocation costs whenever a state allows such costs," the road is paved to seek equitable allowances from the states in connection with the reimbursement incentive. This may require enabling legislation in some states, or new contracts between utilities and the states prescribing the sharing of utility relocation costs for highway improvements.

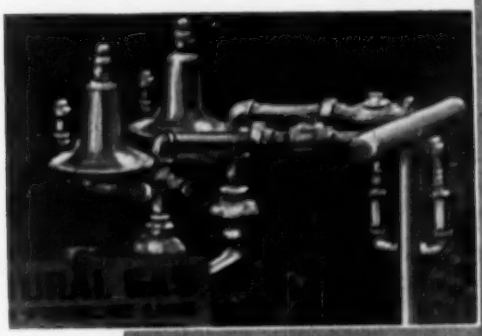
The new pay-as-you-ride highway program apportions the federal funds to the states on a population basis rather than the once proposed basis of highway needs.

CORRECTION

An apology is due Charles B. Gamble Jr. of Alabama Gas Corp., Birmingham. In the June issue of GAS (p. 93), we said he had been promoted to vice president in charge of operations for Laclede Gas Co. We had the position right but the company wrong—Mr. Gamble is with Alabama Gas where he has been "most happily employed for quite a span of years." Before his recent elevation, Mr. Gamble was vice president in charge of engineering at the Birmingham utility.

A WIDER RANGE

. . . of Delivery Pressure Control



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GAS calendar

August

27-29 . . 16th Annual Appalachian Gas Measurement Short Course—West Virginia University, Morgantown.

September

7 . . New Jersey Gas Association Annual Meeting—Spring Lake, N. J.

11 . . NEGA Safety Conference—Hotel Statler, Boston.

11-13 . . Pacific Coast Gas Association Annual Meeting—Hotel Del Coronado, Coronado, Calif.

12-14 . . Mid-West Gas Association Gas School and Conference—Iowa State College, Ames.

12-14 . . 3rd Annual Electrical Conference of the Petroleum Industry (AIEE)—Kansas City, Mo.

14 . . NEGA Commercial-Heating-Industrial Division—Wachusett Country Club, West Boylston, Mass.

14-15 . . Maryland Utilities Association Fall Conference—Cavalier Hotel, Virginia Beach, Va.

18 . . SGA Fall Transmission Management Conference—Statler Hilton Hotel, Dallas.

18-19 . . AGA Accident Prevention Conference—Shirley-Savoy Hotel, Denver.

19-21 . . Southeastern Gas Association—Hotel Sir Walter, Raleigh, N. C.

October

15-17 . . AGA Annual Convention—Atlantic City, N. J.

22-26 . . National Safety Council—Chicago.

31 . . NEGA Operating Division—Hotel Statler, Hartford Conn.

November

12-15 . . American Petroleum Institute—Conrad Hilton Hotel, Chicago.

1957

February

3- 5 . . 27th Annual Mid-Winter Conference, Public Utility Buyers Group, National Association of Purchasing Agents—Brown Hotel, Louisville, Ky.

March

11-15 . . National Association of Corrosion Engineers—Kiel Auditorium, St. Louis, Mo.

21-22 . . New England Gas Association Annual Meeting—Hotel Statler, Boston.

25-27 . . Mid-West Gas Association—Hotel Nicollet, Minneapolis.

28-29 . . Oklahoma Utilities Association Annual Convention—Tulsa.

April

8-10 . . National Conference of Electric and Gas Utility Accountants—Sheraton-Park Hotel, Washington, D. C.

8-11 . . GAMA Annual Meeting—The Greenbrier, White Sulphur Springs, W. Va.

8-11 . . AGA Distribution, Motor Vehicles and Corrosion Conference—Rice Hotel, Houston.

16-18 . . Southwestern Gas Measurement Short Course—College of Engineering, University of Oklahoma, Norman.

16-18 . . AGA Sales Conference on Industrial and Commercial Gas—Jung Hotel, New Orleans.

29-May 1 . . Southern Gas Association Annual Convention—New Orleans.

May

6- 7 . . AGA Residential Gas Section Eastern Sales Conference—Hotel William Penn, Pittsburgh.

9-10 . . AGA Gas Supply, Transmission and Storage Conference—Mark Hopkins Hotel, San Francisco.

20-22 . . AGA Mid-West Regional Gas Sales Conference—Edgewater Beach Hotel, Chicago.

20-22 . . AGA Chemical Engineering and Manufactured Gas Production Conference—Balmoral Hotel, Miami Beach, Fla.

June

23-27 . . Canadian Gas Association—Jasper Park Lodge, Jasper, Alberta, Canada.

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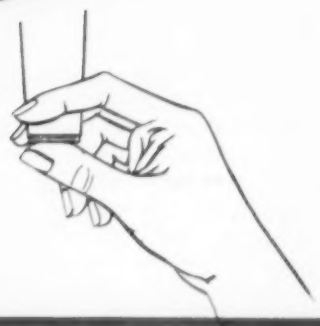

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Continued from page 17

try before the committee was that there is little lobbying connected with the bill, and that most of the activities of the proponents was directed at educating the public as to the needs and benefits of the bill.

Tempers were a little tight several times in the jammed high-ceilinged subcommittee sanctum in the Senate office building as the hearings got underway. One of the early witnesses, Paul Kayser, of El Paso Natural Gas Co., and one-time chairman of the now-defunct Natural Gas & Oil Resources Committee, told Sen. McClellan after several hours of probing questions, that it would be "all right with me for you not to" pursue legislation in the gas field. He had earlier indicated that this was based on the theory that producer's problems, the question of regulation, is two-thirds solved because "the regulation is going to follow what the consumer wants."

But his blunt statement ended a bit of rather heated questioning by McClellan who snapped back with a flush, "that's all I wanted to know."

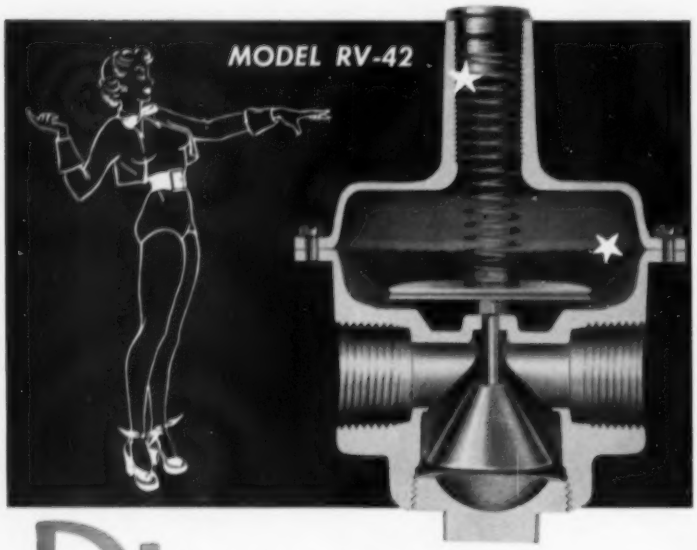
Aside from the lobby hearings, the gas industry representatives in Washington have been quietly attempting to unravel the tangled threads of regulation fouled by the President's veto. Once unraveled, they believe they can begin weaving a new answer to the problem of freeing producers from impending controls. While the associations in Washington have not yet come up with a new approach, and are not even admitting that they are making much progress, there is a growing fear that unless they do something soon, the Federal Power Commission will move even deeper into the regulatory powers it doesn't want, but is at present required to exercise.

FPC deliberately ignored its virtual mandate in the U. S. Supreme Court Phillips case decision pending Congressional action on a gas bill, these Washington gas men say. They are apprehensive that unless there is some definite indication that a new—and successful—effort will be made next year, FPC will go deeper and deeper into drafting and enforcing controls over producers.

With Congress adjourned until January, the gas industry will have a chance to retire from the political firing line, regroup, and work out a detailed program for next year.

Another question mark for the gas industry to ponder is what position the new FPC commissioner, Arthur Kline, a former Wyoming state court judge, will take on the basic issues facing the Commission. His votes will be extremely important on such matters as use of natural gas for secondary purposes; what types of controls should be exercised over pipeline producers as well as independents, if any, and the pending application by Transcontinental Gas Transmission and Midwestern Gas to import Canadian gas.

The U. S. Supreme Court, often



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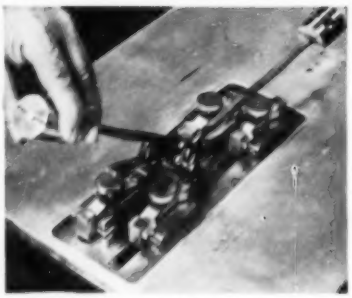

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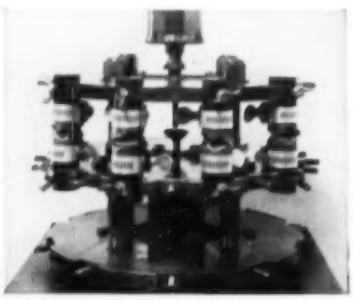

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the center of bitter controversy in the past and the cause of the gas industry's problems over producer controls, is deeply enmeshed in criticism again. Chief Justice Earl Warren, rounding out his second full term, is in the eye of the storm.

A flood of proposals has erupted in Congress to limit the high court's powers, to change qualifications of future justices, and to restore to the states some of the power allegedly taken from them by the court.

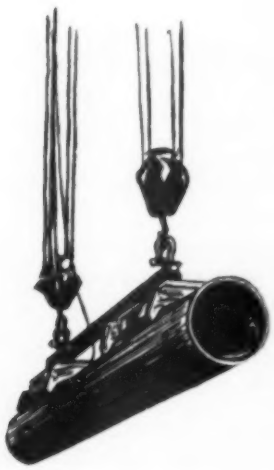
Principal criticism of the court is that it has usurped the powers of Congress and of the states and is making, rather than interpreting, law in such cases as the school segregation and natural gas decisions; by outlawing state antisedition laws; modifying "right-to-work" laws, and by limiting the power of states and cities to discharge employes who plead the fifth amendment against self-incrimination.

Among the more than 70 bills directed at the Supreme Court are measures to prevent the court from ruling that federal laws supersede state laws unless Congress specifically says so; to prohibit the court from reviewing any decision which has been in effect 50 years or more unless Congress specifically permits a review, and to require that all future justices have a minimum of experience (about 10 years) on lower court benches.

The bill to limit the power of the court to review decisions in effect for 50 years or more (H. R. 11795) sponsored by Rep. Carl Vinson (D.—Ga.), would, if passed, knock out the hated Phillips case decision. It would be retroactive to Jan. 1, 1954, thus overruling the June 7, 1954, gas ruling, and obviate the need for another gas bill.

In addition, passage of this legislation, while hard to accomplish, would have the support of hosts of groups angry at various recent court decisions, and would not bear the stamp of the gas industry alone.

It's highly doubtful that the wrath of the anti-Supreme Court factions in Congress will cool much between now and next January when Congress gets down to work again. It may even get hotter as the lawmakers tour home districts mending fences, because most of it comes from antisegregationists who seem to be getting madder as time wears on.



Yard model (right) sits directly on ground, with no rot or corrosion danger. Can be fastened to stakes. Wall model (above) has slots in flange, slips over screws.

Meter Dome

solves housing problems, cuts reading costs

Meter readers can make up to twice as many calls per day when sets are outside, and protected by a genuine one-piece Fiberglas Meter Dome. Emergency shut-offs are quicker, servicing is easier, annual painting is unnecessary, and installations are more economical.

Get the complete story today on money-saving plastic Meter Dome. It's your best buy in the meter cover field.

Transparent models (left) show roominess of Meter Domes. Either one easily holds any size domestic meter, meter bar and regulator.

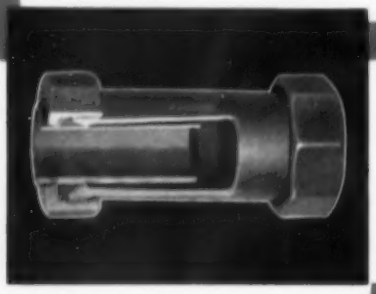
the Buckeye Supply Co.

18 HARRISON AVE. • ZANESVILLE, OHIO

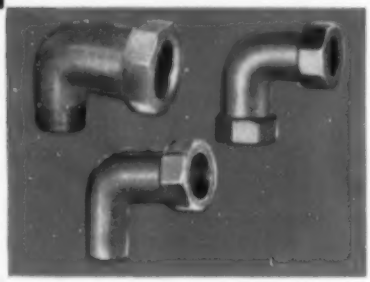
NORMAC

Couplings, Sleeves and Fittings for ☆ UNIFORMITY ☆ DEPENDABILITY ☆ ADAPTABILITY

Normac gas distribution products are engineered and manufactured to meet every requirement of modern gas distribution. Write today for catalog.

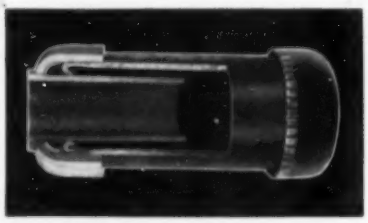


NORMAC COUPLINGS
Normac malleable couplings and sleeves offer the ultimate in deflection and strength with a center wall thickness greater than the wall thickness of the service pipe on which they are used. Every Normac fitting is individually air tested.



COMPRESSION-END "ELLS"
Normac ells of all types incorporate every feature of the Normac coupling plus full coupling depth.

COMPRESSION-END SERVICE "TEE"
Full coupling depth. Special threads on male end prevent dropping into old hand taps.



NORMAC #60-A STEEL COUPLINGS
Manufactured from extra heavy wall pipe. Couplings are available with either seamless or welded centers in sizes from ¾" to 1½" inclusive. 10" and special length centers available.

Normac also manufactures a complete line of red brass fittings in O.D. sizes: ⅝", ⅞", 1¼", 1⅜"—and a complete line of insulated couplings and fittings.

NORTON-McMURRAY MFG. CO.
122 South Michigan Avenue — Chicago 3, Illinois

Couplings · Meter Sets · Unions · Cocks · Bell Joint Clamps · Service Tees & Ells

GAS news

Nebraska community may buy distribution system

An election is anticipated in Central City, Neb., to decide whether the city should repurchase the distribution system it sold 10 years ago to Kansas-Nebraska Natural Gas Co.

City officials are awaiting a ruling by the federal court of appeals on an appeal in a gas rate dispute before calling for the election.

Central City, one of 82 Nebraska communities served by Kansas-Nebraska, sold its distribution facilities to the company in 1946. The company has since been selling its gas there under a 25-year franchise order. Before the sale, Central City manufactured and sold its own gas.

In 1947 Kansas-Nebraska voluntarily gave a 10 per cent rate decrease, City Attorney Phares said. In 1954, the company asked for a 25 per cent increase and Central City was one of four communities which originally refused to grant it.

Federal Judge Delehant found, in effect, that the contracts held by the communities with Kansas-Nebraska were valid, thus precluding the rate increases. It is on this ruling that the company has appealed.

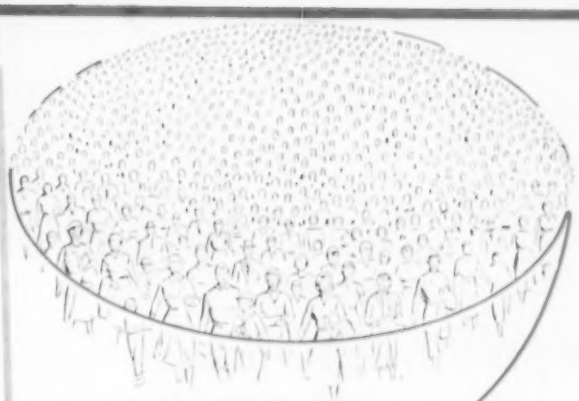
Phares said Kansas-Nebraska has offered to sell the local distribution system to Central City for between $88,000 and $89,000. "If we bought the system we would plan to buy gas wholesale from Kansas-Nebraska and sell it retail," he said.

Packaged kitchen hit of home show

What is believed to be the gas industry's first complete package, the "Holiday Kitchen," was introduced recently at the Orange County Home Show in Santa Ana, Calif. Builder George M. Holstein & Sons featured the color-matched

Rounding Up Prospects by the Millions!

BE SURE THIS BRAND
is on the range you buy
ROPER
Tem-Trol
AUTOMATIC
TOP BURNER
TRADE AND SAVE DURING
OLD STOVE ROUND-UP TIME
WRITE FOR
FREE FOLDER HG
EXCLUSIVE ON
ROPER
"America's Finest GAS Range"
Makes Any Utensil AUTOMATIC
Here's carefree cooking . . . better cooking. "Tem-Trol" accurately holds any heat you want . . . frying-hot to serving-warm. Foods cook just right every time. No burning or boil-overs. With "Tem-Trol" on the job you're free for other things. Geo. D. Roper Corporation, Rockford, Illinois.
Easy Cooking Without Looking!
Bacon without burning
Perfect Hollandaise sauce assured
Cream soups without curdling
Ask, too, about ROPER "arRANGEable" Built-in GAS Ranges, • and ROPER "Dry-Aire" Automatic GAS Clothes Dryers



HERE'S THE SCORE:

The large, colorful ad at left appears in House & Garden's September issue and House Beautiful's October issue. Other Roper ads appear in House & Garden's Book of Building, Living and Woman's Home Companion, reaching . . .

6,000,000 PROSPECTS BEING PRE-SOLD ON THE ROPER "TEM-TROL" BRAND

In the eye-catching spirit of the Old Stove Round-Up, Roper ads this fall aim at prospects in every area. Get your share of results. Identify your store as Roper headquarters in your advertising . . . in store displays . . . any way you can. Promote Roper and the Round-Up . . . you'll corral new gas range sales and profits!

TIE IN WITH THE OLD STOVE ROUND-UP

GEO. D. ROPER CORPORATION, Rockford, Illinois

IT'S OLD STOVE ROUND-UP TIME

Geo. D. Roper Corporation
Rockford, Illinois

I want to tie in with Roper on the Old Stove Round-Up. Rush me full details and franchise information.

Firm Name .....

Individual .....

Street Address .....

City ..... State .....

GB56

appliances in his "Crown Jewel" model home.

Included in the model home was the new O'Keefe & Merritt built-in range and oven and the 1957 Servel built-in gas refrigerator.

Also part of the all-gas Holiday package was Day & Night's Jetglas water heater and Lifeguard forced air heat unit, and the RCA-Whirlpool washer-dryer.

Originated just a month before the Orange County show opened, the Holiday Kitchen package proved highly popular, according to the hostesses who manned the home constantly to demonstrate and explain the new features of the home during the five-day event.

Orange County Home Show queen Janice Johnson shows Joseph Schulte (left) head of Holiday Kitchens, and Justin Kennedy, Southern Counties Gas Co., the new Servel built-in gas refrigerator with Ice-Maker. The new refrigerator made its debut at the home show, along with the complete all-gas Holiday Kitchen package.

Headed by Joseph H. Schulte, one of the nation's package and building field pioneers, Holiday Kitchens will soon be operating in 11 cities throughout the U. S. It is currently operating in Los Angeles.

Rate expert bill passes Massachusetts house

Massachusetts' State Department of Public Utilities will be authorized to spend up to $50,000 a year to retain experts to testify for the public in utility rate cases if the state senate passes a bill now before it.

The bill, already passed by the House of Representatives, was sponsored by Rep. Pasquale Caggiono, who contended that the utilities hire "high-priced specialists to appear for them at these rate hearings, while the public is at a handicap because of fund limitations."

Also up for senate debate is another bill providing that the state attorney general's office represent the public at all rate hearings.

Koppers buys 176-acre site for research center

A 176-acre tract of land near Monroeville, Pa., has been purchased by Koppers Co. Inc., as the site for a new multi-million dollar research center.

Dr. Paul W. Bachman, vice presi-

The WILKINSON LINE LOCATOR

SEES AND TELLS

It will instantly locate all subsurface pipes, cables and such, and determine their depth too. The etched circuitry, our latest innovation, assures better quality control and performance than the customary hand wiring method. You can avoid damaged structures and loss of time with the Wilkinson Line Locator.

The new loop antenna is designed for greater selectivity and the printed circuitry eliminates the usual variations. These improvements make this instrument outstanding.

Our instrument cases are now made with wear resisting phenolic material.

WILKINSON PRODUCTS COMPANY

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MECHANICAL JOINT ACCESSORIES

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Strong — Corrosion Resistant — Light Weight—Sizes 2" thru 12"

High Strength Cast Iron Tee Head Bolts and Nuts

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CADILLAC CAST PARTS CO.

Subsidiary of

Cadillac Malleable Iron Co.

Cadillac, Michigan

dent and director of research and development for Koppers, said that Koppers expects that the scope of its research program will be tripled within the next 10 years.

At present, the majority of the company's research work is carried on at the Verona, Pa., research center. Transfer of these facilities to Monroeville will be gradual. The company doesn't anticipate that the Verona facilities will be completely given up for at least four years.

Tentative plans call for a research center consisting of laborstories, pilot plants, a power plant, an administration building and auxiliary facilities. These will be constructed over a period of years. Next year construction will begin on the first building—a chemical laboratory.

Program readied for measurement short course

Speakers have been announced for the 16th annual Appalachian Gas Measurement short course, scheduled for Aug. 27-29 at West Virginia University, Morgantown.

Capt. C. V. Hawk, USN, director of U. S. Naval Boiler & Turbine Laboratory at the Philadelphia Naval Base, will present the principal address. O. W. Van Petten, vice president of the Columbian Carbon Co., will be the other featured speaker at the opening session.

Purpose of the course is to provide information on application, operation, and repair of natural gas quantity measurement and pressure regulation equipment. Latest developments of this equipment will be exhibited by 45 leading gas equipment manufacturers.

Howard S. Bean, National Bureau of Standards, Washington, D. C., is general chairman of the short course and H. B. McNichols, Columbia Gas System Service Corp., is program chairman.

Present fuels are here to stay

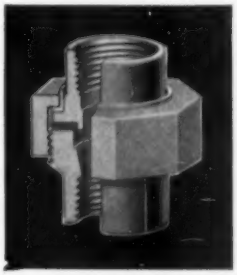
Neither solar energy-power from the sun's rays nor domestic atomic energy will be developed fast enough to diminish the demand for the fuels that now supply power, heat, and motivation for the nation, according to F. Finley Carter, acting director of the Stanford (Calif) Research Institute.

Mr. Carter, speaking to a group of western gasmen, said that major scientific victories are needed in the field of fuel utilization to keep pace with America's rapidly rising demands for energy in home and industry. America will need "all of every fuel," including natural and manufactured gas, oil, and coal, in the years to come in order to cope with the steeply rising rate of energy consumption.

"Although efforts to effect practical use of the sun's rays are mounting daily," Mr. Carter said, "no one can say with certainty when or to what extent solar energy will be able to shoulder a significant portion of man's energy burden. The prospects that solar energy will assume a significant portion of the power load are nil."

He went on to say that "it is unlikely even with the most favorable circumstances that nuclear power plants will be installed fast enough in the next two decades to keep up with the rising requirements for electricity. We can expect that not only will existing fuel-fired power stations serve their useful life, but also that new ones will be built."

He advanced four possible goals for science in the field of maximum fuel utilization:



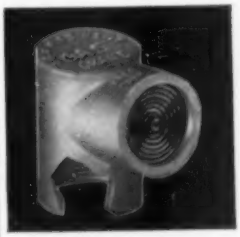
New
CRANE Malleable Iron
Insulated Union

Gives cathodic protection at meters—Galvanic corrosion in service piping can be effectively reduced by cathodic protection at meter connections. This rugged, malleable iron Crane union breaks the current path by means of special insulation.

Between union ring and tail-piece there's an L-shaped washer of laminated phenolic thermosetting plastic. Between tail-piece and thread-piece a thick black rubber gasket breaks the metal-to-metal contact. Both insulating parts have high dielectric strength.

New union measures just slightly longer than the regular ¾-inch Crane malleable union—approximately 2-7/32 inches, end to end. Packaged in cartons of 30.

Check your Crane Representative on these items!



New ¾-inch
Safety Vent Elbows

A flexible stainless steel coil spring takes the place of the old bar grille or rigid screen in this new Crane vent elbow. Keeps out bugs, insects, foreign matter. Flexes outward if regulator is vented. Durable, dependable —die cast of zinc alloy.

CRANE

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

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The One Pipe Wrench that
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all others...

Genuine Heavy-Duty
RIDGID

This pipe wrench does its job so well that millions of users swear by it. It's extra strong and safe—sure jaw action aided by new patented hookjaw suspension—grips pipe or conduit instantly, no slip, no lock. Rugged comfort-grip I-beam handle... handy pipe scale and easy-spin adjusting nut every user likes. Every wrench factory tested, 6" to 60"... to assure you *most* for your money. Buy RIDGIDs at your Supply House!

RIDGID
Work-Saver Pipe Tools

The Ridge Tool Company, Elyria, Ohio, U.S.A.

1. A means of developing electric power directly from natural gas without burning the gas.

2. Development of a practical method of storing low-level heat generated from warm gases, liquids or solids. The amount of energy now dissipated to the air at power plants, at virtually every industrial plant, and even in homes, is "certainly a substantial part of the total energy output."

3. Development of a means of conserving the energy of heat of a few hundred degrees or less at reasonable cost. Here, he said, a "major scientific breakthrough is needed," with consequent "enormous rewards to society."

4. Development of large plants operating near deposits of low-grade coal to process coal to liquid or gas, or both, and leaving a residue of char acceptable as fuel for furnaces of a steam electric power plant.

Union Gas anticipates large expansion

When long-term supplies of natural gas become available either from Alberta or the U. S., Union Gas Co. of Canada Ltd. will launch "the largest single natural gas construction project yet undertaken in southwestern Ontario," David P. Rogers, president, told the annual meeting of stockholders recently.

"Not only are we ready to expand into areas within our present market territory," he said, "but our plans have been completed for a large diameter pipeline which we will build to the vicinity of Hamilton. We will then be able to convert Hamilton and supply other important centers . . . as well as smaller communities and other distributing companies."

The company, he said, has completed all hearings before the U. S. Federal Power Commission and is awaiting final decision on its application to import large additional quantities of gas from Panhandle Eastern Pipe Line Co.

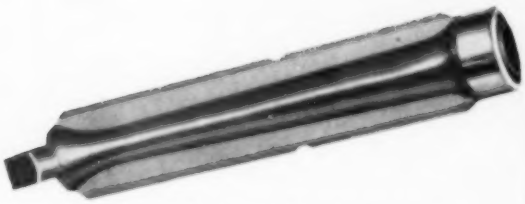
"If the Washington decision is favorable, this expansion program will get underway as fast as possible," Mr. Rogers said. "If, however, the decision is unfavorable, we will have to await the arrival of Alberta gas before this expansion can be undertaken."

Under a recently revised contract with Trans-Canada Pipe Lines Ltd., Union Gas will take much larger quantities than could be committed

Webster

provides quality plus in the

WEBSTER KINETIC®



At no increase in cost to you, the Venturi tube and flame retention nozzle unit of the famous WEBSTER KINETIC® now is fabricated from steel. Longer life and smoother operation is assured from a lighter weight unit.

The heavy gauge chrome alloy nozzle is also standardized on the ROTONETIC and HC DYNETIC units.

This is just another example of Webster's ability to engineer and manufacture a more efficient and economical "tool" for burning gas. In its class no other commercial or industrial burner can compare cost wise with quality.

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WEBSTER ENGINEERING *Company*

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Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

QUALITY PRODUCTS
JOHN WOOD
SINCE 1867

For QUALITY and SERVICE

Glass-lined or Galvanized

JOHN WOOD Automatic Gas Water Heaters are highest-quality heaters, known for their dependable, trouble-free performance. Nationally advertised. Fully warranted. A wide variety of sizes, models, and prices to meet any sales situation.

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Made and warranted by one of the country's oldest, most reliable water heater manufacturers, Conshohocken, Penna. and Chicago, Ill. Approved by the American Gas Association and endorsed by Mrs. America®.

Sell Satisfaction
Sell PEERLESS
and
"Keep" the Profits!

Why take Quality for granted . . . why jeopardize your reputation and profits on brands of questionable ability to stay sold? . . . Call-backs, service calls, complaints and dissatisfied customers rob profits and reputation.

Peerless has New Styling that appeals to all . . . that clinches the sale . . . with engineered perfection that provides the heating performance you'll want to sell.

Only Peerless has exclusive Directional Louvers that provide best circulation and keep walls clean. This is only one of the many desirable features that sell Peerless . . . and keep it sold.

Made to Sell
Made to Last
Made to Satisfy

Peerless
GAS
CONSOLES

A full range of sizes . . . 11 models in all . . . from the 14,000 B.T.U. "mighty midget" to the 60,000 "low-boy." Radiant and plain models. Write today for five color brochure that gives you every detail on the most distinctive profit line.

ONLY PEERLESS OFFERS MORE EXCLUSIVE FEATURES THAT MAKE SELLING EASY

SELL THE HEATERS MOST FREQUENTLY ASKED FOR BY NAME.

Peerless
MANUFACTURING CORP.
Louisville 10, Ky.

COMPLETELY AIR-CONDITIONED

HOUSTON'S
WELCOME TO THE WORLD . . .

THINGS YOU'LL LIKE ABOUT THE RICE . . . four fine restaurants, delicious food . . . central downtown location . . . garage service . . . 100% air conditioned for year-round comfort . . . reasonable rates . . . home of the fabulous Petroleum Club.

The RICE Hotel
IN THE HEART OF HOUSTON, TEXAS

when the original contract was signed. The maximum annual quantity in the 13th and succeeding years is 64 billion cu ft, of which Union is committed to take 75 per cent annually.

"In contracting to purchase a minimum of 48 or a maximum of 64 billion cu ft in the 13th year," Mr. Rogers said, "we are estimating that the sales of Union Gas Co., including sales on a wholesale basis, will increase by over 300 per cent in the next 13 years if the requisite supply of gas is available."

The 25 per cent leeway in the Trans-Canada contract gives the company sufficient flexibility to purchase any gas produced locally. Mr. Rogers also cited new purchase agreements with Imperial Oil Ltd. and Consolidated West Petroleum, which, with several other smaller contracts, will increase purchases during the current fiscal year by more than 1.5 billion cu ft.

Distribution planned by Ark-La Gas, five towns

Arkansas Louisiana Gas Co. and five Arkansas towns have been given authority by the Arkansas Public Service Commission to build transmission lines and local distribution systems costing approximately $1.2 million.

The western Arkansas towns of Havana, Belleville, Plainview, Danville, and Ola have voted bond issues to build their own distribution systems, which they will lease to the company with an option to buy. Arkansas Louisiana will spend $451,550 on transmission lines to serve the area.

Idaho distribution controversy settled

Intermountain Gas Co. and Idaho Natural Gas Co. have settled their battle over natural gas distribution in southern Idaho. Officials said that Idaho Natural, loser in the year-and-a-half fight, has agreed to drop its appeal to the state supreme court.

The struggle started in February 1955 when the Idaho Public Utilities Commission issued a permit to Idaho Natural after rejecting applications of Intermountain and the Pocatello Natural Gas Co.

This action was unanimously reversed by the state supreme court last October, however, and the PUC subsequently withdrew the permit from Idaho Natural and awarded it instead to Intermountain.

Noting that the agreement "removes the only remaining obstacle in making natural gas available to southern Idaho this year," Intermountain Gas is ready to start laying pipe in the 23 cities it is franchised to serve.

Northern Illinois hunting for new gas supplies

While Northern Illinois Gas Co.'s gas supply is sufficient to meet basic demands, the continuing demand for househeating poses a formidable problem that the company is making a determined effort to solve.

Company president Marvin Chandler told stockholders recently of five principal steps in the campaign for increased gas supplies.

1. Geological and engineering studies of a storage cavern which would hold as much as 10 million gal. of propane—equal to more than 900 MMcf of gas. The company now has more than 3.5 million gal. of propane stored in high pressure tanks.

2. Geologists are trying to find natural underground storage domes in the company's territory which would be similar to the Herscher project of Peoples Gas Light & Coke Co.

3. Suppliers are studying the possibility of storing gas in depleted oil and gas fields in central and southern Illinois.

4. The company is studying the economics of gasifying coal.

5. NI-Gas Supply Inc., a Northern Illinois subsidiary, is working with gas and oil operators in a search for gas and oil in the offshore area of the Gulf of Mexico. As a participant in this project, Northern Illinois would retain a pro rata share of any oil or gas discovered and would have an option to buy gas belonging to most of the other participants.

Mountain Fuel names Utah banks agent and registrar

Mountain Fuel Supply Co., Salt Lake City, has named two Salt Lake banks as capital stock transfer agent and registrar, according to MFS President W. T. Nightingale.

The First Security Bank of Utah is transfer agent and Utah Savings & Trust Co. is registrar. Mellon National Bank & Trust Co., Pittsburgh, will also continue as a capital stock transfer agent for Mountain Fuel, and Peoples First National Bank & Trust Co., also of Pittsburgh, remains a registrar.

Look what Trenchmobile® can do for you

On house-to-street service connections, Parsons 88 Trenchmobile makes vertical set-ins, flush with foundations. Hinged crumber swings up, out of the way — positive down-crowd boom starts cut fast, holds accurate grade. It also undercuts walks, curbs, cross-pipes, saves costly hand clean-up. Shiftable, reversible spoil conveyor dodges trees, hedges, poles, and other side obstructions. On many operations, Parsons Trenchmobile backfills its own trench — 6-foot blade optional.

Digs 8 to 16 inches wide

When your work schedules call for main-line extensions, pipe reclamation, or trouble-shooting, this utility-size trencher has plenty of capacity to fill the bill. You get trench widths from 8 to 16 inches, depths to 5 feet. Digging speeds range from 0 to 14.5 feet per minute.

Self-sharpening "Tap-In" teeth assure maximum digging efficiency at every depth, width, in all materials. Hinged crumber sweeps trench bottom clean, ready for pipe. Consider, too, what Trenchmobile's rubber-tired mobility can mean on your scattered trenching jobs.

Drives anywhere

A job 6 miles away can be started in less than 30 minutes from "now". Trenchmobile drives around town at 12.6 m.p.h. There's no waiting for trailer — and no loading or unloading delays.

Better see your Parsons distributor soon, or send for Trenchmobile catalog. (Also check Parsons big, crawler-mounted Trenchliners®.)

Want more facts?

mail to: PARSONS Company, NEWTON, IOWA (Koehring Subsidiary)

Send us latest catalog on rubber-tired 88 Trenchmobile.

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COMPANY _____ DIV. _____

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What's inside makes a big difference!

The diaphragm inside your meter determines the accuracy of your recordings. Vulcan Diaphragms are your assurance of accuracy, long-life and minimum maintenance.

Pioneer in the Synthetic Diaphragm field, Vulcan stays ahead with ultra-modern development and manufacturing facilities.

Another REEVES VULCAN RUBBER PRODUCT

REEVES BROTHERS INC.

Vulcan Rubber Products Division
54 Worth Street, N. Y. 13, N. Y.

Gas Meter Diaphragms
Diaphragms for Regulators & Controls

GAS people

Promotions

M. Y. Hibler
Southern Union

O. L. Slaughter
Southern Union

MARION Y. HIBLER has been promoted to general superintendent of the Galveston distribution system of Southern Union Gas Co., Dallas. He is succeeded as service and installation superintendent at Austin by O. L. SLAUGHTER JR., who has been a training specialist since joining the company in 1953.

Clark Bros Co., Olean, N. Y., has appointed JAMES B. HICKEY as sales engineer in the Washington, D. C. office. He succeeds WILLIAM E. DOBBINS, recently named central regional sales manager.

Brown & Root Inc. has elected LOUIS E. MINOR, manager of the pipeline department, a vice president. Its affiliate, Brown & Root Marine Operators Inc., has elected HAL A. LINDSAY to a vice presidency.

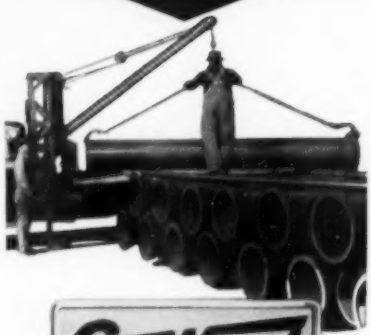
WILLIAM H. KINNEY has been appointed assistant to the vice president, operations, for Kaiser Steel Corp., Oakland, Calif.

H. M. MCCAMISH, formerly operations superintendent, has been promoted to the newly created position of chief engineer (development) of the Sui Gas Transmission Co. Ltd. in Pakistan.

K. M. THOMPSON, who has been district sales manager for the state of Iowa, has been named manager of the metropolitan New York branch sales office of Ruud Manufacturing Co., Kalamazoo, Mich. He succeeds the late DON C. NICOL.

THEODORE S. PETERSEN has been appointed assistant sales manager for the Quick-Way Truck Shovel Co., Denver. Since 1955 Mr. Peter-

FULL POWERED *for faster, safer, easier operation!*



GarWood

CRANES

Utilities find the full powered operation of Gar Wood 2400 series cranes an important advantage in handling transformers, pipe, poles and large commercial appliances.

All operations—hoist, boom and swing—are fully powered and individually controlled by separate levers conveniently located at the side of the crane. Automatic swing cutouts prevent overswing. All these features add up to fast, simple operation... complete, full-time control...greater accuracy for spotting loads...maximum safety.

Gar Wood cranes are real space-savers, too. They require a minimum amount of space behind the cab...permit maximum payloads, do not interfere with regular use of body when crane is idle.

Gar Wood 2400 series cranes have a maximum capacity of 4.4 tons. Other series available with capacities from 1½ to over 8 tons. For complete information, see your Gar Wood-St. Paul distributor, or mail coupon below.

GAR WOOD INDUSTRIES, INC.
Wayne, Michigan • Richmond, Calif.

MAIL FOR SPECIFICATIONS
CUSTOMER SERVICE DEPARTMENT G-4
GAR WOOD INDUSTRIES, INC., Wayne, Mich.

Please send me free Bulletin No. WC-202R that describes Gar Wood truck-mounted cranes.

Name_____
Title_____
Firm_____
Address_____

sen has been district sales representative in the states of California, Nevada, and Arizona. DOUGLAS CORNER succeeds Mr. Petersen in his former position.

J. K. HAWK has been made vice president in charge of engineering and elected a member of the board of directors of the F. J. Evans Engineering Co., Birmingham, Ala. Other newly elected officers are N. B. BUEHRER, executive vice president; D. M. MILLS, vice president in charge of the Houston division; and JACK J. TYSON, vice president in charge of the Atlanta division.

ALLEN WILSON has been elected a vice president and DUDLEY W. DAY a member of the board of directors of Burgess-Manning Co. Mr. Wilson is manager of the company's architectural products division in Chicago and Mr. Day, who is also a vice president, manages the Penn Instruments division at Philadelphia.

Joe Darrow
Lone Star

A. P. Rowland
Lone Star

JOE C. DARROW, vice president in charge of Lone Star Gas Co.'s Fort Worth distribution division, has transferred his headquarters to Dallas, where he will be vice president in charge of all distribution operations of the company. A. P. ROWLAND succeeds Mr. Darrow in the Forth Worth position.

HARVEY FANSHIER has been named midwestern representative for Corrosion Rectifying Co., Houston. He will make his headquarters in Great Bend, Kan.

Several promotions have been announced by Grabler Manufacturing Co., Cleveland. WILLIAM C. LINDQUIST, who has been vice president and comptroller, is now executive vice president; R. H. STACKHOUSE JR., formerly sales manager, is vice president-manager of sales; and SAUL Z. COLE, recently supervisor

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Two feet per minute average pushing time

GREENLEE Pushers are available in two sizes: No. 790 for ¾" to 4" pipe . . . No. 795 for pipe over 4", concrete sewer pipe, large ducts. Average performance of No. 790, shown above with power pump, two feet per minute. Write for literature.

GREENLEE

GREENLEE TOOL CO.
Division of GREENLEE BROS. & CO.
1948 Columbia Avenue, Rockford, Ill.

of sales in the Philadelphia, Atlanta, and New Orleans territories, is assistant manager of sales.

ROBERT E. BAKER JR. has been appointed vice president, operations, and elected a director of General Gas Corp., Baton Rouge.

LAURENCE E. FROST, formerly staff assistant in the office of the president of Consolidated Edison Co. of New York, has been named assistant to Vice President Charles B. Delafield. He will be engaged in special assignments.

According to an announcement from Crane Co., Chicago, J. W. GREENE is now director of industrial sales and W. A. BURBINE is director of heating sales. Both men have been promoted from their posts as district managers.

ARTHUR W. MANLEY has been elected a vice president of Mississippi River Fuel Corp., St. Louis. He will continue in his former position of secretary. C. J. MAURER has been named treasurer to succeed CHARLES SHUTTLEWORTH, who is retiring.

Heath Survey Consultants Inc., Wellesley, Mass., has announced the appointment of several district supervisors. The men and their districts are: ARTHUR R. DILLON, western Pennsylvania, eastern Ohio, and West Virginia; RUSSELL H. KOLTS, Michigan and parts of Ohio, Indiana, Wisconsin, and Canada; FRANK R. FAIR, Arkansas, Louisiana, Oklahoma, Texas, New Mexico, and Arizona; A. A. STEINLE JR., Mid-Atlantic states; and GEORGE E. SERPIS, New England operations.

American Meter Co., Philadelphia, has named ROBERT R. TROYER as assistant to the advertising manager. The company has also appointed RICHARD E. MARTIN as sales engineer for the Pittsburgh sales district. He will headquarter at Lexington, Ky.

IRVIN G. MCCHESNEY has been promoted to manager of nuclear energy research for Rochester (N. Y.) Gas & Electric Corp.

W. C. DAHLMAN, formerly El Campo district manager, has been made head of Houston (Texas) Natural Gas Corp.'s engineering department, succeeding C. A.

Continued on page 86

life's full of COMPLEXITIES

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Worries . . . Worries! Rush . . . Rush!

Hold on there, mister. Forget your ulcers for a minute and sit back and relax . . . while you read about a product that's simplicity itself. Connelly Iron Sponge. No complicated installation problems here. No high finance either. Just a basic, direct solution to your problem of gas purification. Connelly Iron Sponge simply and surely protects your equipment from corrosion caused by Hydrogen Sulphide, and at the same time lowers your operating and maintenance expense. Proven by more years of actual "on-the-job" experience than any other method! Moreover, it is equally effective at high or low pressures, with excellent capacity and activity. You'll find also that it gives long life between foulings and that it is easily rejuvenated. If you need further convincing, send us the details of your problem. We will gladly give you our recommendation without obligation.

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Gas Digest

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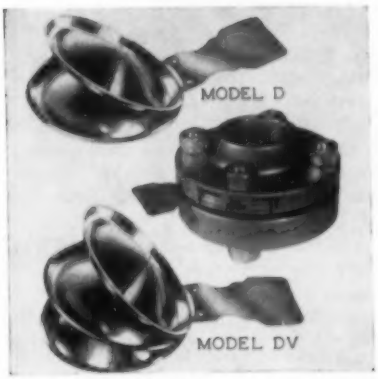
New Products and Trade Literature

For more data on any of these items use the Readers' Service Card on pages 83, 84



1. Rupture disc

A new type rupture disc that extends the advantage of safety head protection to many installations now operating under pressure, temperature, and corrosive conditions is available from Black, Sivalls & Bryson.

The rupture disc is the heart of the safety head assembly, made from a variety of thin ductile metals.

Range for high temperature applications is extended with the new D and DV rupture discs, which also provide maximum service under pulsating or reversing pressure conditions and permits closer operation to rupture pressure.

Black, Sivalls & Bryson Inc.

---

2. Pipe joint compound

Positive seal against practically all known highly corrosive liquids and solvents is claimed by a new pipe joint compound from Crane Packing Co.

Developed for services up to 212°F, the "John Crane" Chemlon compound uses DuPont Teflon as its base. The non-adhesive quality of Teflon and the non-hardening characteristics of the compound allow connections to be quickly and easily disassembled. Chemlon pipe joint compound is particularly adaptable for use on aluminum, stainless, monel, or plastic pipe, and is currently available in 2-oz screw-type jars.

Crane Packing Co.

---

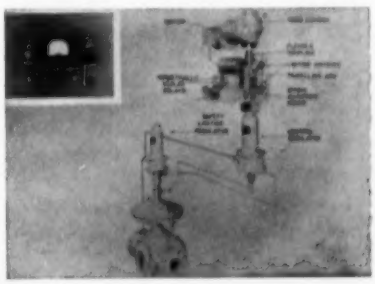
3. Submersible motor

General Electric's new submersible pump motor is designed for deep-well water pumping. To overcome difficulties in operating submerged in water, this motor has specially designed, water-lubricated bearings.

The new unit is filled with a propylene glycol-water mixture (to prevent freezing during shipment), and is then factory sealed. With the aid of a spring, the water-glycol solution is kept inside the motor under pressure greater than that of the water outside.

All portions of the motor which are exposed to water are built of corrosion-resistant components.

General Electric Co.



4. Remote control system

Added safety and improved service for city gas distribution systems are offered by a new electrically operated pilot regulator remote control system from Rockwell Manufacturing Co.

Designed for use in intermediate and high pressure pilot-loaded distribution circuits, the new system enables an operator at a central control station to raise or lower the pressure setting on pressure regulators 10 to 15 miles away. By using a telemetering arrangement to spot pressure changes, he can rectify immediately any undesirable pressures at circuit outlets.

Dubbed the "Telapilot," the new system consists of a control panel assembly connected via telephone wires with a regulator station assembly. The latter assembly includes cabinet, reversible electric motor, gear box, two hermetically sealed relays, and two limit switches.

Rockwell Manufacturing Co.

New Loo

SAME SOLID SATISFACTION

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SMALL RATCHET PIPE THREADERS

You'll like the rifle barrel, rust resistant finish of the TOLEDO ratchet Threader—the drop head tool that lets you change dies instantly. Pull the pawl—the die drops out. Slip in another and you're ready to go. It's that easy. Check the new bright red ball end for easier handling, better grip. It's quality, like all TOLEDO tools. ⅛" to 2" sizes. See them today at your suppliers.

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PORT-A-PONY

The No. 68 Power Drive will be the handiest tool on your truck. Takes power to the job—up the ladder, on the scaffold, in the ditch. Electric or air driven. Turns, threads, cranks, lifts, pulls, or rotates. Makes an ideal bench tool, too.

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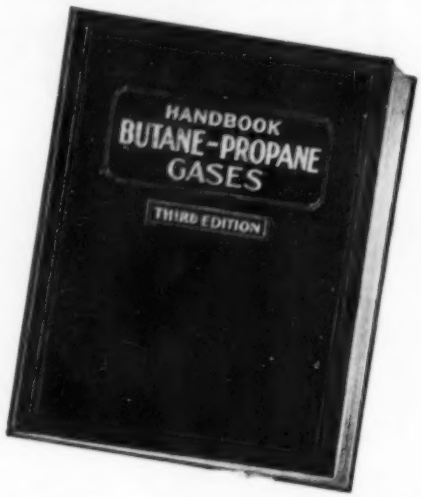

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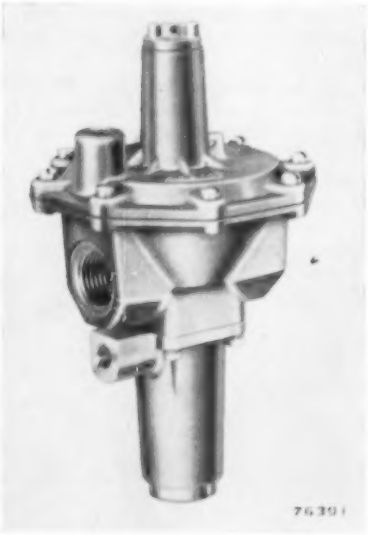
5. Mass spectrometer

Additional equipment which permits automatic multi-stream and multi-component analysis is incorporated in a modified process-monitor mass spectrometer from Consolidated Electrodynamics.

The instrument was designed to monitor gases from oil wells to permit closer control of the underground combustion of residual oil reserves. It consists of a standard Consolidated Type 21-620 process-monitor mass spectrometer, an automatic programmer, a peak selector, and piping and valves. There are nine sample lines, eight for sampling the flowing streams and one for the standard sample — a static supply.

Consolidated Electrodynamics

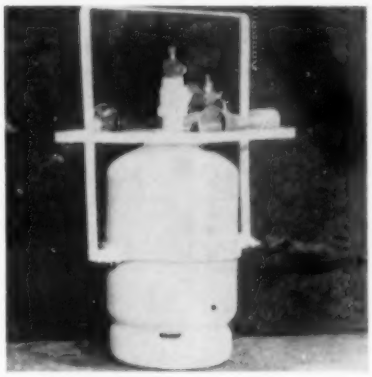


6. Appliance regulator

A new appliance regulator in combination with a Thermo-Electric pilot and a safe-lighting feature is offered by Thermac Corp. According to the manufacturer, the use of this control minimizes the number of separate control units ordinarily installed on an appliance manifold.

Designated the SL, the new unit is available in ½- and ¾-in. sizes for capacities up through 250,000 Btu per hour.

Thermac Corp.



7. Signaling horn

Development of a new self-powered and explosion-proof signaling horn designed for use in gas transmission systems, chemical and petrochemical plants, and petroleum refineries has been announced by Falcon Alarm Co.

The portable horn has an open-air audible range of more than 1000 ft on industrial sites and can be heard more than 150 ft above the average plant's ambient noise level.

The dual-tone signal horn creates a sound ranging from 116 to 120 decibels and will blow continuously for more than half an hour or sound a minimum of 500 five-second warning blasts without recharging. It is powered by Du Pont's non-deteriorating and non-toxic Freon. The unit consists of a standard 10-lb cylinder of Freon 12 topped by two Falcon-engineered horns of slightly different pitch.

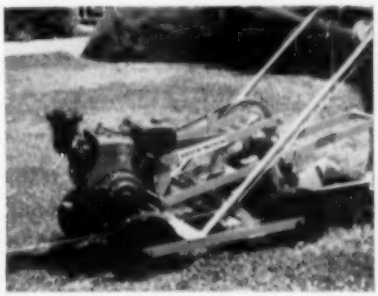
Falcon Alarm Co, Inc.

8. Refrigerator bezel

Servel Inc. has answered the growing trend to built-in kitchen appliances by making every refrigerator model in its new line easily adaptable for recessed installation.

Available is a refrigerator bezel (or frame) made of anodized and polished aluminum. It exactly fits the contour of the large 34-in. Servels on the sides and top. Or, the soft, ductile aluminum may be easily cut to fit narrower models.

Servel Inc.

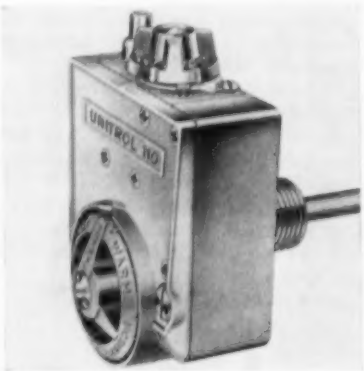


9. Trencher

The new lightweight Baby Ditch-Witch trenching machine will cut a 2-in. wide trench at any variable 2-in. depth to 18-in. depth. This Model B is also built with a 12-in. bucket line.

The unit is powered by a 2.5-hp engine. Only 25 to 30-lb manual pressure is required on the handle bars for an 8-in. trench in average soil. In harder digging, the Model B may be pulled forward by a simple hand winch attached to the handle bars.

Charles Machine Works



10. Water heater control

Production is under way on Robertshaw-Fulton's Unitrol 110, a new automatic control for gas water heaters.

Although functional design is the distinctive feature of the 110, the company has standardized many of the components of the Unitrol line in order to help manufacturers reduce inventories and servicing. The magnet assembly, filter cartridge and valve assembly of the Model 110 are interchangable with those of other Unitrols.

All Unitrol 110 connections are straight down and parallel. Its

legible temperature and gas cock dials can be read from both top and front. A red pushbutton at the top permits quick resetting of the pilot. Other features include non-clog pilot gas passage ports, bit capacity filter cartridge, powerful electromagnet, and improved C valve adjustment.
Robertshaw-Fulton Controls Co.

11. Secondary regulator

A secondary regulator for converting small engines to run on natural gas is announced by Beam Products Manufacturing Co.

The new Beam 102N regulator, weighing only 2¼-lb. is 2 in. thick and 5¾ in. in diameter. It has vacuum lock-off power adjustment and idle adjustment all built in. The 102N will operate up to 35-hp motors with 6-oz natural gas and up to 65-hp motors with 5-lb natural gas.
Beam Products Mfg. Co.

12. Truck tool boxes

Wilhelmsen Sheet Metal Works claims that its all-steel tool boxes increase truck carrying capacity and provide a safe, easily accessible place for small hand or power tools. All units are constructed of 14 and 18 gauge steel. They are designed to fit all standard pickup trucks and are installed with minimum rear view obstruction.

The tool boxes are available in half-ton and three-quarter ton sizes.
Wilhelmsen Sheet Metal Works

13. Wall heater

Cool Cabinet hanging wall heaters have been added to the Quaker Manufacturing Co. line of home gas heaters. Designed to hang on walls like pictures, the new wall heaters are available in both vented and unvented models.

The heaters are available in capacities of 25,000 and 40,000 Btu input. The vented models are equipped with S-1 Addatrol safety shutoffs.
Quaker Manufacturing Co.

14. Electrical hammer

A new lightweight electrical hammer for maintenance and construction work has just been announced by Ingersoll-Rand.

Weighing only 12 lb, 13 oz, the tool will drill holes in concrete up to 1⅛ in. in diameter. The tool delivers up to 1900 blows per minute. Operations may be performed on a variety of materials, including concrete, macadam, stone, cinder blocks, wood, metal, tile, and dirt.

Known as the H54U electric power hammer, the tool features a spring-floated piston, with the sealed spring accelerating the piston to produce a more powerful blow. This design is said to prevent leakage and loss of power.
Ingersoll-Rand Co.

15. Trenching machine

Auburn Machine Works has converted the International 300 utility tractor into a balanced trenching machine. A geared spacer—with all gears running in oil—has been inserted behind the tractor transmission. This spacer lengthens the wheelbase 6 in., puts more weight on the front wheels, and makes for smoother digging and straighter trenches.

A hydraulic drive provides power for propulsion while digging at any digging speed up to 600 ft/hr, depending on soil conditions.
Auburn Machine Works Inc.

16. Casing bushings

Bushings for pipelines in casing under highways and railroads are now available for all line pipe down

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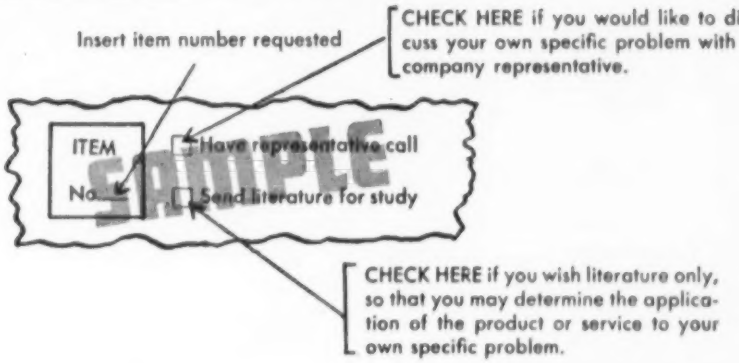
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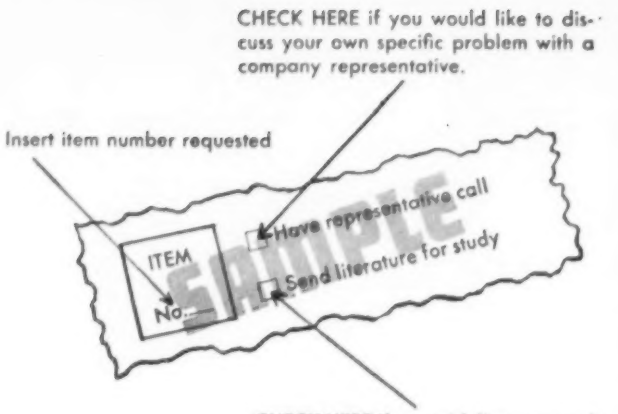
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to 2-in. sizes from T. D. Williamson Inc.

New design features include stainless steel bands and clamps which provide a tighter seal and are hand-tightened. This continuous solid ring of tough synthetic rubber, which withstands the weight of backfill earth, effects a perfect seal on bare pipe as well as on coated pipe. The extra thick shoulder incorporated in the design prevents the casing edge from cutting through the bushing.
T. D. Williamson Inc.

17. Insulating assembly

An insulating assembly which is in essence an insulating nipple has been introduced by Plastic Engineering & Sales Corp. According to the company, the assembly does away with the field problem of threading steel nipples into plastic threading couplings.
Plastic Engineering & Sales Corp.

18. Pipelayer attachment

Utilities and others specializing in small-diameter pipelines will find a useful tool in the pipelayer attachment announced by Midwestern Manufacturing Co. for use with Caterpillar D2 tractors.

Known officially as the No. 2 sideboom, the new pipelayer has a lifting capacity of 8400 lb at 2-ft overhang. Hydraulic controls operate the heavy-duty boom and load winches. A 1200-lb counterweight helps provide needed stability, as does the long track frame of the special D2 tractor arrangement used with the new pipelayer.
Midwestern Manufacturing Co.

19. Flow meter

Barton Instrument's new Model 236 pressure-compensated continuous integrating flow meter senses differential and static pressure, extracts and continuously integrates their square root values, and totalizes their product, without use of cams or intermittent devices. It consists of the Barton Model 199 rupture-proof bellows unit combined with the Librascope Model 90 pressure compensated flow computer.

The instrument indicates both differential and static pressure and continuously totalizes flow on a six-digit counter. A built-in switch provides a means for transmitting a remote reading to a control or data-collecting system.
Barton Instrument Corp.

GAS trade literature

20. Algae-control bulletin

Control of algae and other microscopic organisms which complicate overall water treatment programs in cooling systems is discussed in a new leaflet from Allis-Chalmers Manufacturing Co. The use of No. 102 Series Algaecide is described and a table illustrates its effectiveness on six different species of algae.
Allis-Chalmers Manufacturing Co.

21. Product bulletin

The latest improvements, specifications, and complete performance data for Herman Nelson horizontal and vertical unit heaters are contained in a new 36-page product bulletin from American Air Filter Co. Bulletin 700A includes complete hot water and steam performance tables, dimensions, selections, applications, and other technical data.
American Air Filter Co.

22. Detector bulletin

Beta Corp.'s line of manually reset vibration monitors and malfunction detectors is described in a new four-page bulletin (No. 500-1A). Included is detailed information on how vibration monitors detect malfunctions in rotating equipment and how the devices are installed and adjusted.
Beta Corp.

23. Product Catalog

New appliance servicing items, such as Griffoam leak detector and a serviceman's complete wrench kit for flared fittings on ranges, are among products shown in the 1956 Griffith's catalog. A feature in the catalog is a set of three orifice-sizing tables for natural and L.P. gases.
E. F. Griffiths Co.

24. Motor bulletin

Tri-Clad 55 explosion-proof motors from General Electric are described in a new eight-page bulletin. Discussed are design features and maintenance of new induction motors (1 through 30 hp) for use in hazardous locations.
General Electric Co.

25. Regulator bulletin

Thermac Corp. has published a new bulletin covering its line of appliance regulators. Pressure drop and capacity curves together with dimensions, photographs and other pertinent information are included.
Thermac Corp.

26. Ditcher catalog

A new line of pipeline and utility ditchers from Gar Wood is presented in a 16-page catalog. A number of new engineering developments, including the Gar Wood-Buckeye hydraulic conveyor drive, are discussed and illustrated.
Gar Wood Industries

27. Pipe design handbook

"Design Pressures for Steel Pipe for Gas Transmission and Distribution Systems" is an 83-page reference work for all gas pipeline engineers. Issued by Ladish Co., Bulletin 55-2 presents allowable working pressures conforming to recently revised Section 8 of the ASA Code for Pressure Piping. The book is durably bound and is tab-indexed for easy, quick reference.
Ladish Co.

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(Continued from page 78)

BLANCHARD, who has joined the Fish Service & Management Corp. in Houston.

Three new vice presidents have been elected by the board of directors of the Public Service Co. of Colorado, Denver. They are R. T. PERSON, who heads the company's information, publicity, advertising and employee education operations; G. W. THOMAS, who is responsible for commercial activities; and P. A. YETTER, who is manager of division operations throughout the state.

WILLIAM S. BUNNELL has been named vice president in charge of the Reading (Pa.) gas division of United Gas Improvement Co. He succeeds ALLYN G. TAYLOR, who retired recently.

R. E. HERMANN has been promoted to district sales manager of Iowa Southern Utilities Co., Burlington, Iowa. He succeeds the late R. H. ROCKHOLD.

JOHN B. FROST has been promoted to manager of the new business department of Brooklyn (N. Y.) Union Gas Co. Also promoted is FRANK R. BARNITZ, who becomes assistant manager of the new business department.

PAUL W. ROGERS has been elected vice president and chief engineer of the Ohio Fuel Gas Co., Columbus. He has been assistant vice president and chief engineer.

MAYES PIERCE has been promoted to consultant supervisor by Southern Cross Foresters, Atlanta. Most recently, Mr. Pierce served as district chief consultant.

GEORGE F. NAST has been promoted to assistant manager of the publicity and advertising department of Brooklyn (N. Y.) Union Gas Co. Other promotions include WALTER BENNETT to art supervisor of the display studio, OSWALD CHAMBERS to new supervisor of the display studio, and JOSEPH H. DI NAPOLI JR. to display foreman.

Mayes Pierce
Southern Cross

George Nast
Brooklyn Union

ROBERT E. SCHILL, manager of the department of economic research of Brooklyn (N. Y.) Union Gas Co. for several years, has joined the management staff of Central Vermont Public Service Corp., Rutland. He will serve as special financial assistant to the president.

Three key promotions have been announced by Rockwell Manufacturing Co., Pittsburgh. GILBERT T. BOWMAN, general products manager, and J. W. NORTHCUTT, southern regional sales manager, have been named assistant vice presidents. JACK H. WALTERS, product manager-petroleum and industrial liquid meters, will move to Rockwell's southern regional headquarters in Atlanta, succeeding Mr. Northcutt.

Several reassignments of executive personnel have been announced by Consolidated Edison Co. of New York. All the men involved are vice presidents of the company. L. A. SCOFIELD is now in charge of commercial relations and retains his supervision of operations in Westchester county and Staten Island. OTTO W. MANZ JR. directs sales, M. LECOMPTE WARING is now

Paul Rogers
Ohio Fuel

G. T. Bowman
Rockwell

J. W. Northcutt
Rockwell

Jack Walters
Rockwell

W. J. Crowley
Northern Illinois

R. J. Smith
Southeast Alabama

responsible for purchasing stores and fuel. HARRY J. BAUER and J. ELIOT MCCORMACK are in charge of operations, including production, distribution, system operation, substation operation, and test. EARL L. GRIFFITH has assumed jurisdiction over commercial buildings.

WILLIAM J. CROWLEY has been elected vice president and comptroller of Northern Illinois Gas Co., Bellwood, Ill. Mr. Crowley has been comptroller of the company since 1954.

Transfers

R. J. SMITH has joined the Southeast Alabama Gas District, Dothan, as general manager. He formerly served as general manager of a similar district operation in Louisiana.

H. W. GEYER, formerly director of the West Coast research laboratory of Robertshaw-Fulton Controls Co., has become a consulting engineer in gas utilization and a manufacturers' agent.

WILLIAM R. CURLEY has joined Royston Laboratories Inc., Blawnox, Pa., as sales engineer. He will headquarter in Monroe, La.

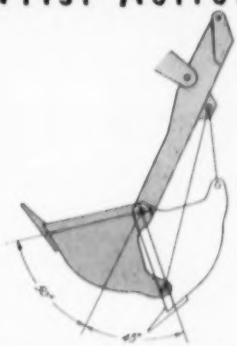
Deaths

A. B. HAYES, field superintendent of O. R. Burden Construction Corp., Tulsa, died recently in Dallas.

GEORGE T. KELLY, controller and treasurer of Southern Counties Gas Co., Los Angeles, died recently. Mr. Kelly, who went on disability in 1954, joined SoCounties in 1948 following a career with Southern California Gas Co. which dated back to October 1929.

CHARLES O. KALMAN, 84, board chairman of the Minneapolis (Minn.) Gas Co., died recently.

HYDROHOE'S Wrist Action Puts the Twist Where it Pays



You're always using the best penetration angle when you dig with Bucyrus-Erie Hydrohoe's wrist-action utilities dipper. Designed specifically for utilities work, this 20-in. wide dipper is hinged at the lower front end of the dipper handle and rotates hydraulically from 45 degrees behind the handle to 50 degrees ahead.

You change angle of penetration as you dig — simply by flicking a lever. The resulting larger loads, reduced spillage and maximum penetration gives you faster leak repairs, manhole excavations, valve pits. Trenches deeper than they are long can be cut with squared or undercut ends. Rocks are moved, and buried pipe or conduit uncovered with far less danger of damage. In addition to all this, the boom telescopes hydraulically to add reach and depth, and may save up to 40% of move-up time.

These tailored-to-your-work features combined with the Hydrohoe's light truck mobility, fast set-up, solid outrigger support, and quick convertibility to crane front-end sets it ahead of any ordinary excavator for on-the-go utilities work.

In addition to the special utilities dipper, the Hydrohoe is offered with a narrow-type 12-in. wide dipper, with the standard 18-in. wide dipper, and with wide-type dippers up to 60 inches. For complete information get in touch with your Bucyrus-Erie distributor. Ask him about the Hydrocrane, too.

151H56

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Corrosion Prevention

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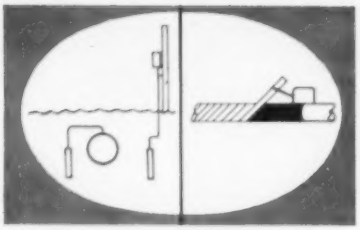

By GUY CORFIELD

Corrosion coupons

A favorite and effective means of obtaining comparative and quantitative data on corrosion and protection is by use of corrosion "coupons." These coupons are pieces of metal, usually in sheet or strip form, which can be as small as a postage stamp, or a square foot or more in area, depending on the application. They are exposed to or immersed in the corrosive environment and are either bare and directly subject to corrosion, or are covered with a material which is itself under test as a protective coating.

In any event, it is the corrosion of the surface of the metal coupon that is observed visually, and evaluated quantitatively by measuring pits and determining loss of weight. It is important that the coupon be of the same type of metal as the structure that is subject to corrosion. In problems of external or internal corrosion of pipelines, for instance, it is conventional to cut coupons from a piece of the same pipe. It is even more important that the surfaces of coupons that are being used for comparative purposes be uniform both individually and severally. Otherwise, the corrosion results may be erratic and misleading. Uneven surface conditions can cause local galvanic corrosion and pitting; an oxide or scale coating may resist corrosion; and deep scratches or other indentations can make the metal unusually susceptible to attack.

Cleaning with a solvent, or light sandpapering or acid pickling, may not be sufficient. Oxide and other chemical films can be quite deep and a recently reported investigation showed, for instance, that steel sheet had a leaded surface presumably resulting from the lead heating coils in the mill pickling tank. Relatively heavy sandblasting, or severe sandpapering or acid pickling, is recommended.

As additional precautions against erroneous results, metal coupons should not be bent, or straightened if bent, or cut by

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..CARBIDE'S CARBOSEAL Anti-Leak man, with the answer to leakage due to dried-out fiber packing in bell-and-spigot joints.

Many gas companies have learned from George Briggmann that *CARBOSEAL Anti-Leak is:*

- effective
- inexpensive
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forceful shearing, or subjected to any force that will develop unequal metal stress and therefore encourage unequal corrosion. If installed in contact with liquid, they should be electrically insulated from metal supports or contact, so that there will be no electrolytic action between the coupon and the support or contacting surface, either to accelerate or retard corrosion of the coupon.

Insulating joint materials

At the AGA Distribution, Motor Vehicles and Corrosion Conference in Chicago, May 7-10, 1956, a report entitled "Insulating Joint Materials—Final Report of Task Group" was presented by the chairman of the task group, Hugh L. Hamilton, A. V. Smith Engineering Co., Narberth, Pa. The data shown are the result of answers to a questionnaire designed to determine the current practices in use by the gas industry.

It is stated in the introduction that "Undoubtedly, the increase in attention (to insulating joints) is due to the fact that these devices are the one corrosion control device which is included in gas piping as an integral part of the system. Other corrosion control devices are generally external to the pipe run itself, consequently other devices do not so directly or broadly affect operating personnel. Insulating joints which are required for the majority of corrosion control schemes are encountered in all phases of gas operations."

The summary is as follows:

1. The flange pair is the predominant type of insulating joint employed in high pressure installations and district regulator stations. Of those operators commenting on thickness of dielectric material, the majority specify ⅛-in. thickness.

2. The mechanical coupling style of insulating joint is the predominant type of insulating joint employed in low and medium pressure systems.

3. The method of applying protective coating to insulating joints is widely varied with the predominating approach being the

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ANCHOR'S BUTANE & PROPANE STAND-BY PLANT PACKAGE

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application of the same coating as that used on the pipeline.

4. The use of high voltage protective devices at insulating joints is much more common among transmission companies than other operators. More engineering information is desired on this subject.

5. Periodic testing of insulating joints is more common in the transmission field than in other operations. The interval of test is shorter with the transmission companies.

6. The use of insulating joints in service piping is accomplished in so many various manners that it completely defies tabular analysis.

7. From the safety standpoint it is apparent that more operators are becoming aware of the potential hazards of locating insulating joints in combustible atmospheres.

A new concept in cathodic protection

It is generally considered that an underground pipe coating, when used in conjunction with cathodic protection, should be as good an electric insulator as possible consistent with economic and practical considerations, and ideally (except for the holidays that cathodic protection is expected to "plug") should be a perfect insulator to conserve the protective current. Practically, however, organic type coatings in contact with moist soil are not perfect insulators and the protective current travels through them to small degree but sufficient to produce an alkaline condition and release hydrogen at the metal surface. This in turn tends to impair the bond between the metal and the coating and, in extreme cases, may cause blistering and general deterioration.

Reasoning that the purpose of cathodic protection is to prevent current from leaving the pipe by superimposing a current flow in the opposite direction, and that with presently used organic coatings the cathode of the electric system (where hydroxyl ion and hydrogen are released) is essentially at the metal-coating interface, it is suggested that the coating

be deliberately made conductive. This, it is postulated, would in effect move the cathode to the *outside* surface of the coating (the interface between the coating and the surrounding water or soil) at which point the accumulation and discharge of hydroxyl ions and hydrogen could proceed without deterioration of the coating.

Experiments have been made by loading synthetic paint vehicles, such as vinyl chloride polymer, with high concentrations of metallic pigments such as zinc dust. Eighty per cent zinc by weight (about 60 per cent by volume) has been found to give good electrical conductivity. No data are yet reported on actual tests of this type coating system under cathodic protection conditions, and it is hard to guess what the results may be. Offhand it would appear that to make the coating conductive would merely waste current as it would be more like trying to protect bare pipe, but perhaps some degree of conductivity of coating will prove beneficial. It is at least an interesting concept.

GAS associations

R. M. Conner ends 41-year service to gas industry

Raymond M. Conner, consultant for the American Gas Association Laboratories, retires July 31 after 41 years of distinguished service to the American gas industry.

Mainly through Mr. Conner's untiring efforts, the appliance approval program of the AGA for the protection of the gas-consuming public and the AGA Laboratories as the means to implement the program, have evolved to the present enviable position.

Mr. Conner started his gas industry career in 1915 with the

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RECORDS DEW POINT OF GASES UNDER PRESSURE

SUITABILITY: For use with gases under pressure; at pressures from atmospheric to 3,000 psi.
CONTINUOUS RECORD: of dew point gas.
RAPID RESPONSE: To changing dew point of gas.
RELIABLE RESULTS: Obtained to allow for the control of dew point of natural gas in long distance high-pressure transmission lines. This instrument records dew point of a continuous sample of natural gas at line pressure up to 3,000 psi.

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Roll-down windows, full opening . . . full panel-board head lining and masonite door lining . . . safety glass throughout . . . all-steel welded construction . . . door locks.
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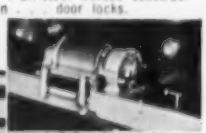
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FOR ALL WILLYS JEEPS, 4 WD TRUCKS AND 4 WD STATION WAGONS.
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Portland (Ore.) Gas & Coke Co., beginning in the distribution department and later serving as head of its meter repair shop. In 1917 he was appointed chief of its testing laboratory.

In 1922 he was named chairman of the gas appliance test code committee of the Pacific Coast Gas Association. As chairman of the committee, he was presented with the Gold Medal award of the PCGA in 1924 for his contributions to the gas industry.

His outstanding accomplishments on the Pacific coast lead to Mr. Conner's selection as director of the newly established lab of the AGA in 1925.

Mr. Conner served for 22 years as director of the lab, until, in 1947, illness required him to relinquish active participation. However, because of his intimate knowledge of the laboratories policies and procedures, and his wide knowledge of the gas industry, he continued his services as consultant until his retirement.

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Canadians choose Palin as association head

Frederick R. Palin, Union Gas Co. of Canada, Chatham, Ont., was elected president of the Canadian Gas Association during its 49th annual convention held in Murray Bay, Quebec, recently.

He succeeds P. W. Geldard, Consumers Gas Co. of Toronto, as chief executive officer of the association.

In his address to the convention, Dean A. Mitchell, president of the AGA, predicted the beginning of a new era for Canada through the development and use of its natural gas resources.

At the same time he cautioned delegates that "when you purchase gas you are no longer autonomous, but depend upon an outside source for your product, and the cost of it will in no way rest in your hands."

The fact that the federal government would assist in financing the Trans-Canada line was described as "a shame to a free-enterpriser." Mr. Mitchell also referred to other problems to be faced—those between producer, pipeliner and distributor and said the type of contracts made at the present time would influence the future relationship.

ASME nominates officers for 1956-57

William F. Ryan, vice president, director and senior consulting engineer of Stone & Webster Engineering Corp., Boston, has been nominated to serve as the 1956-57 president of the American Society of Mechanical Engineers.

He will be installed at ASME's annual meeting in New York in November.

Also nominated were Eugene W. Jacobson, Gulf Research & Development Co., Pittsburgh, technical director; and W. Weaver Smith, Lummus Co., New York, administrative director.

Vice presidential nominees include William H. Byrne, Byrne Associates Inc., New York; James H. Sams, dean of engineering, Clemson (S. C.) College; Rolland S. Stover, R. S. Stover Co., Marshalltown, Iowa; and Clifford H. Shumaker, Southern Methodist University, Dallas.

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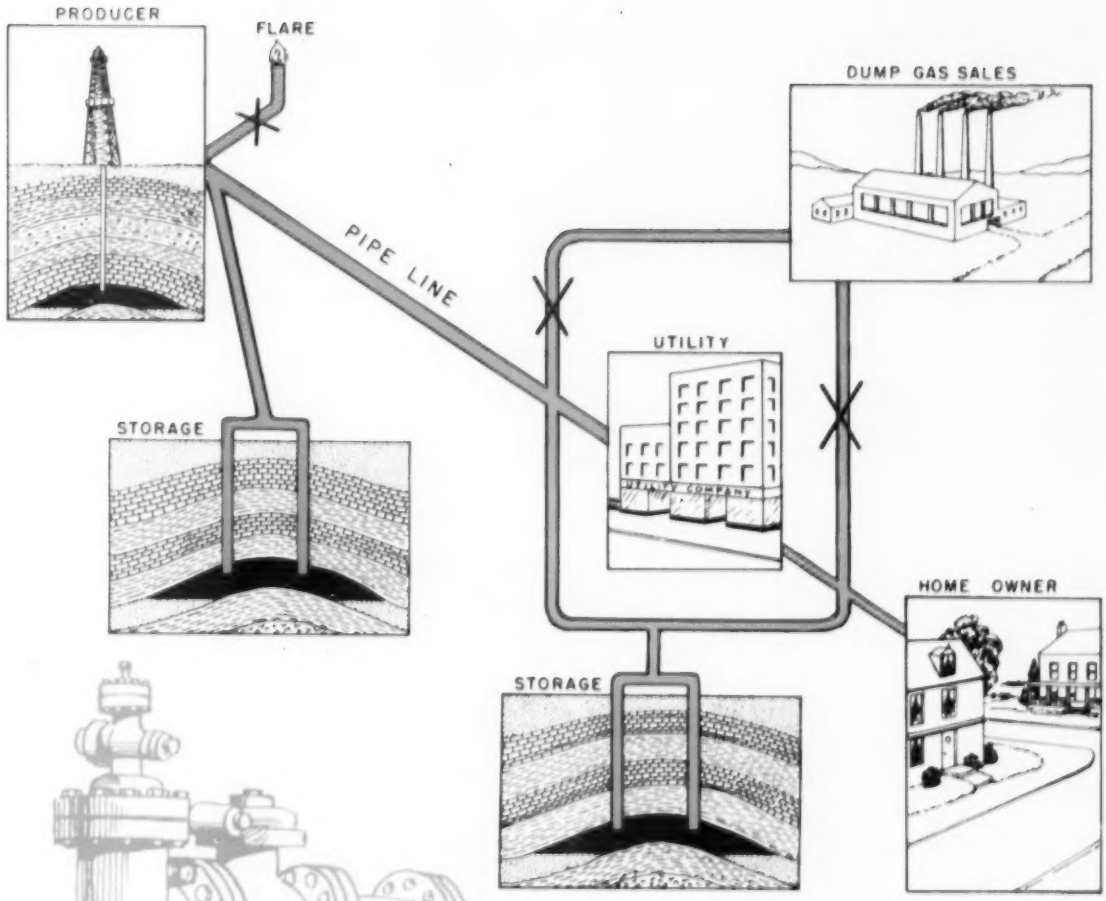
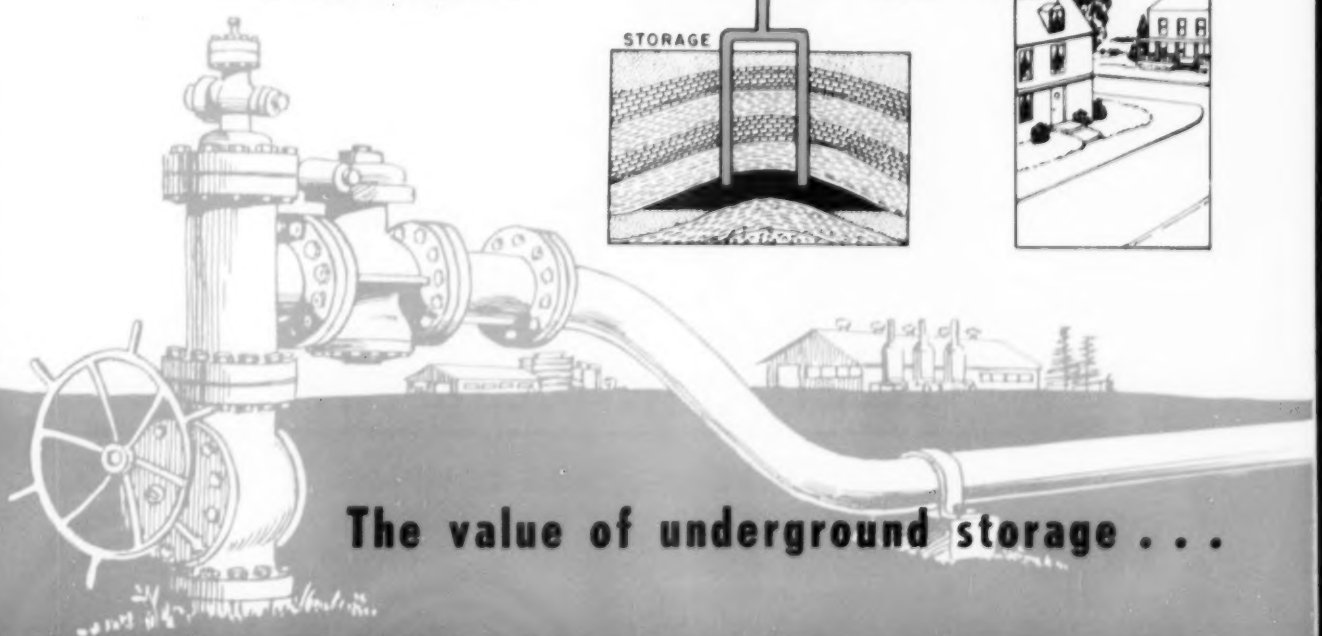
GAS

PIPELINE SECTION

ENGINEERING • CONSTRUCTION • MAINTENANCE





The value of underground storage . . .

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Here are the "Big 5" reasons why Youngstown Electric Weld Line Pipe is your best buy:

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5. Long lengths save you time and trouble

In the process of producing Youngstown Electric Weld Line Pipe, every means is explored to assure uniform wall thickness. Uniformity of wall in the pipe begins with control of the skelp thickness produced on the rolling mill. The experience plus control in the rolling of the skelp by men who know steel makes this uniformity possible. Youngstown as an integrated producer has full control over the skelp rolling as well as the finished pipe production. To test the uniformity and quality, the pipe is then placed in a hydrostatic testing machine where internal pressure is applied. To obtain Electric Weld line pipe of uniform wall thickness—specify Youngstown Electric Weld line pipe for your next pipe line job.

Youngstown maintains sales and service offices throughout the oil and gas producing country—see your area representative soon.

Youngstown

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QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

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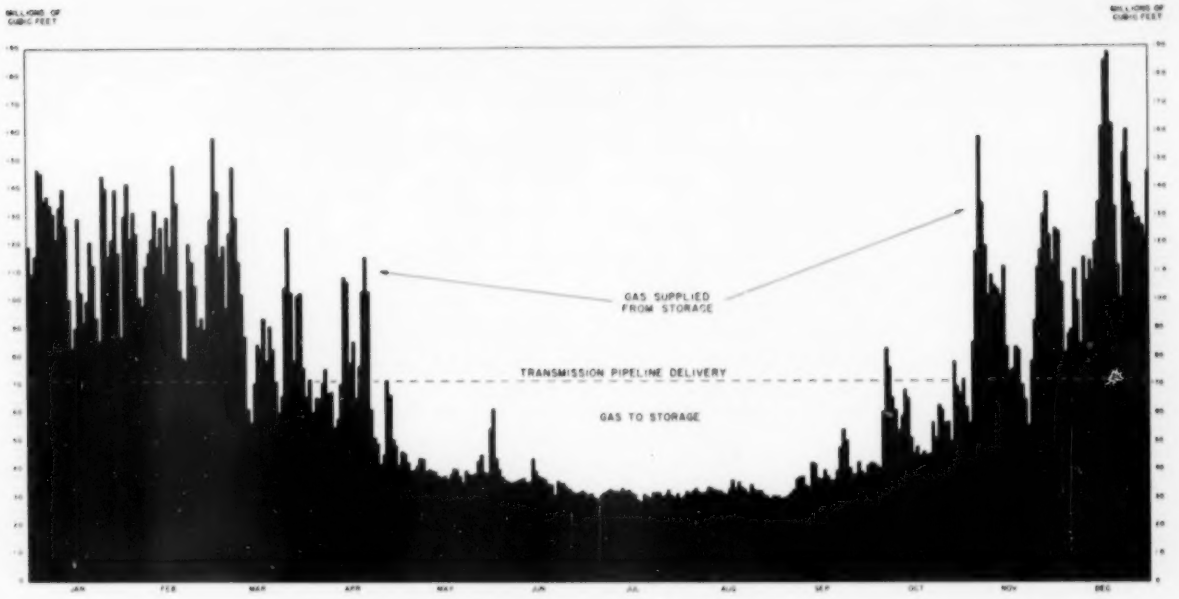


This chart shows the function of underground storage in relation to space heating demand.

What are the reasons for underground gas storage?

This is a question that has many different answers, depending upon what phase of the gas industry you are in. This analysis of the entire underground storage picture will provide the answers.

By DOUGLAS BALL • Ball Associates, Washington, D. C.

GAS storage, for a marketer, is warehousing; keeping stock on the shelf to meet demand between deliveries.

Gas storage, for a producer, is "string saving"; building "odds and ends" of otherwise wasted flare gas into a marketable accumulation.

Gas storage, for both marketer and producer, is also safety insurance. With storage the customer's needs are always supplied even during temporary supply-system failures.

Storage for producer

Associated gas, the gas produced with oil, is not readily marketable. It is produced only as the oil is produced, and oil is produced on the more or less arbitrary schedules of conservation commissions and the oil market. Less associated gas is wasted now than in the past. More and more of it is "cycled" back into the oil fields to help maintain pressure and thereby to increase the oil recovery.

In effect, cycling is field-end storage. The gas eventually arrives at the transmission lines. Except for such by-product storage only a few field-end storages are in use. Much remains to be done and the knowledge to do it with is at hand.

Storage for pipeline

Storage serves the pipeline too. When field-end storage turns associated gas into "gas field gas," it adds to the known sources of pipeline supply. Market-end storage makes possible a nearly constant year-round load whether or not the customer-companies sell interruptible gas.

Storage for utility

Storage assures the customer-company that its gas supplier need

Underground storage...Consumer saves money because fewer and smaller lines are needed

only maintain capacity equal to its average day, not its peak day. With storage, the company needs pipeline capacity of only one third its peak in order to saturate its space heating or household gas market. It need sell no "dump gas" and need buy no "demand gas." It can keep the charges to consumers much lower, without the difference coming out of the company pocket, than it could without the storage.

Consumer benefits

The consumer eventually pays all the costs of his gas supply, so storage serves the consumer most of all. He pays for only a fraction of the pipeline capacity that he would without storage because his suppliers have needed to build smaller or fewer pipelines. The fuel he needs for heating and other household uses is not being sold for "inferior" uses, such as firing boilers. Less gas is wasted at the pipeline sources. The supply is bound to last longer.

Storage does all these things simply by saving low-demand gas until its market is ready for it. Each link in the supply chain operates at or close to a 100% load factor the year around.

At the field end, alternatives to storage just don't exist. Gas burned in flares is lost forever. Even local users of gas as raw material or fuel cannot run steadily and profitably with only an intermittent source.

At the market end the alternatives (all of them less satisfactory than adequate cheap storage) are:

1. Dump gas sales, off-peak gas sold for "inferior" uses;
2. Low load-factor operation, where expensive processes and machinery are run at less than designed capacity;
3. Manufacturing gas, extremely costly and usually inadequate for all but small peaks; and
4. Propane-air mixing which also is ordinarily adequate for only small peaks.

These storage alternatives cost hundreds of dollars per Mcf of capacity. Their output costs or other equivalent costs are high enough that they are really nothing but emergency procedures, not profitable in themselves.

Surface containers

Many things can successfully hold gas. Among them are holders, pipe batteries, and Fuller's earth, which we call here "surface containers." They are all used at or near the ground surface. They are all adapted particularly to small storages and may be used to advantage only for small high-cost storages. Compared to the underground storage method they are expensive. Holders cost hundreds of dollars per Mcf. Pipe batteries or pipe bottles cost tens of dollars per Mcf. Low-temperature liquefaction and storage may cost from $5 to $10 per Mcf of capacity, perhaps considerably less for very large capacities. Acreage requirements may be large, and the hazards may not be easy to overcome.

Underground containers

We know of two underground storage types: pore storage and cavern storage. They have a basic difference from the surface containers because they make use of the higher natural pressures at depths below the surface. They make use of natural materials in place to contain the gas. Chiefly for these two reasons, they lend themselves to large volume, low-cost storage.

Pore storage

Pore storage is the way nature stores gas in natural gas fields. Man does not create pore storage; he only finds and develops it. Vast areas of the earth's crust are made up of sedimentary rocks; rocks laid down by the action of wind and water as layers of sediments. Sedimentary rocks are chiefly of three kinds: sandstones, limestones, and shales.

Sandstones—Layers of sand with various amounts of cementing material form sandstones. In most sandstones, space exists in the pores between the sand grains. The pores are always full of fluids. In most places the fluid is water. Rarely the fluid is oil or gas. In most sandstones the pores are connected, so that the fluids can flow through them. Such sandstones are "permeable" as well as "porous."

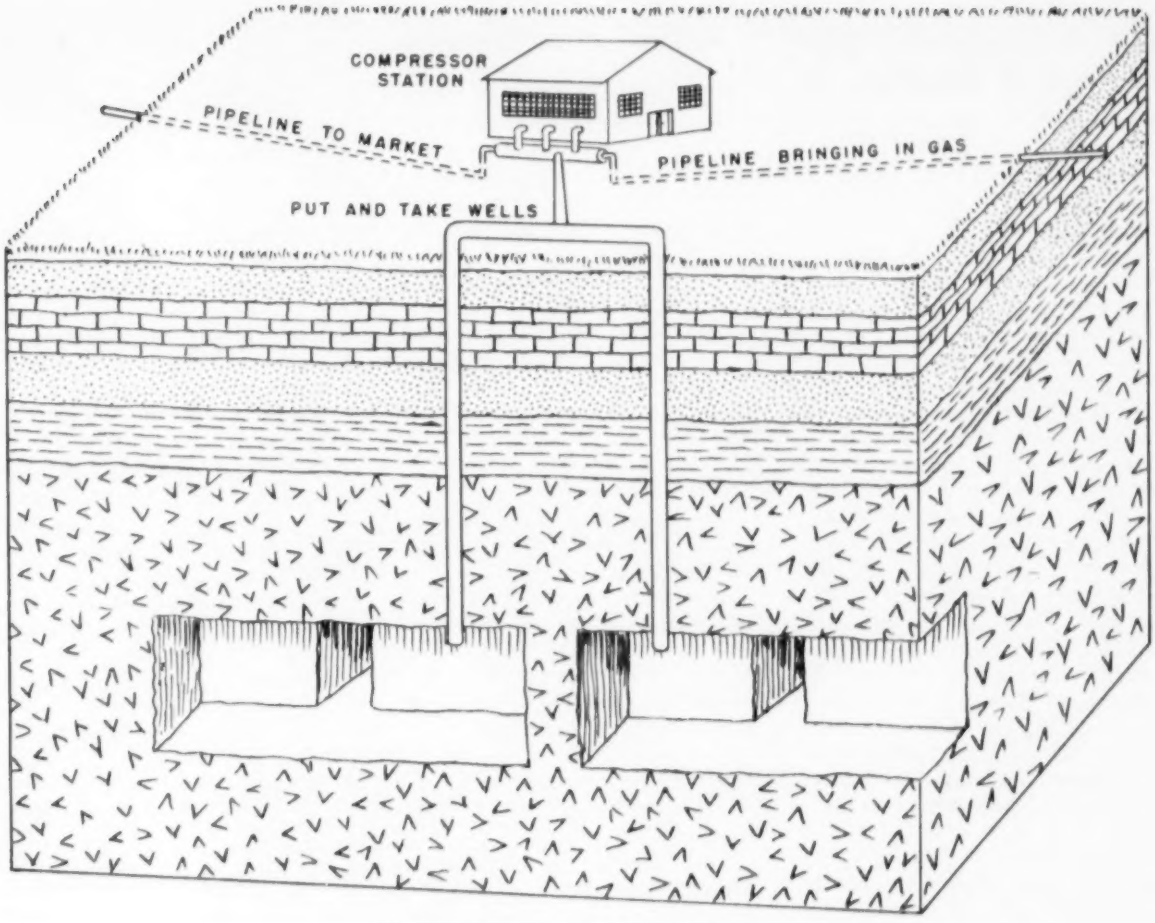
Shales—Shales are made of particles finer than sandstones. Shales may be porous, but they usually are not permeable. The grain sizes are so small that fluids cannot flow. We say that sandstones are commonly good reservoirs, shales very seldom are. However, shales, being impermeable, make wonderful cap rocks. The fluids in sandstones underlying them cannot escape to the surface.

Limestones—Some limestones are not porous and not permeable. Others are porous and permeable, so some limestones are reservoirs; others are cap rocks.

Mixtures of the three rock types occur in nature with various amounts of porosity and permeability.

Structure—Most of the earth's sedimentary rocks have been or are being folded. The earth's crust in shrinking and cooling has been contorted in various degrees, and many of the sedimentaries have been squeezed and bent and twisted. In places the bending takes the form of arches or "anticlines." The crest of a typical anticline has a high spot on it, a spot from which the rock "dips" down in all directions. Horizontal lines drawn at even intervals on the anticline rock surface form concentric, but irregular, rings. The geologist calls such horizontal lines "contours" as similar horizontal lines around surface mountains are called contours by the topographer.

The part of an anticline encompassed by "closed contours" is called a "closed anticline" or "dome." It is similar in appearance to an inverted irregular saucer. Most known oil and gas fields are in closed anticlines where an impermeable cap rock overlies a porous and permeable reservoir bed.



Underground storage of gas in a mined cavern.

Most gas storages are also in such "structures." The gas is in the porous reservoir beneath the cap rock (prevented from escaping upwards and sidewards by the shape of the cap rock) and held there by the surrounding water with which nature has generously endowed almost all deep porous rocks.

The problem of developing pore storage in a given area is largely that of finding a suitable combination of structure, reservoir bed, and cap rock at a suitable depth.

Rights and acreage — Anticlines come in all sizes. Typical ones used for storage cover from a few hundred to 20,000 acres. For many storages the toughest problem of all is the acquisition of storage rights in the underground dome. More than one gas company and its customers have lost millions of dollars worth of storage use because of the reluctance of landowners to permit storage under their property.

A pore storage needs only 50 to 100 acres of surface rights or fee ownership.

Cushion gas—Pore storages operate with a certain amount of "cushion gas"—gas which stays in the reservoir for the life of the field. Cushion gas acts like the spring behind the jack-in-a-box. The spring pushes the "jack" out fast enough for full effectiveness, but it stays in the box. Cushion gas becomes part of the cost of the storage field. Its quantity may be as great as a third to a half of the total gas in the field.

Pore storage costs—So far, the highest cost of pore storage capacity has been slightly under $1 per Mcf of capacity, and the storage cost is about 5 cents or less per Mcf delivered, depending on how fast the investment in the field is written off. Where it can be done at all, pore storage may take two or three years to be put into first use, or may be longer where storage rights are particularly difficult to acquire.

Cavern Storage

Cavern storage is storage in mined or dissolved caverns. Here, too, certain rocks favor storage more than others. Most favorable are dense rocks with no appreciable permeability such as basalts, granites, certain shales, and salt. The chief problem in getting a cavern ready for use for storage is its actual construction. Ordinarily where satisfactory rocks are known they are widespread enough that one has more choice about the cavern's location.

The rock type and condition are

Underground storage . . . Actual construction is biggest problem in use of cavern storage

determined by drilling, sampling, and logging. The rock need not be perfectly homogenous or non-permeable. It can even be rather badly fractured. Special techniques are established for sealing rocks mechanically.

An arrangement of great safety, but less-favorable economics, is to use pressures in the cavern low enough that the ground water pressure seals against leakage. In the "Edholm Container" less than half as much gas can be stored at any depth as can be stored in a mechanically sealed cavern, but the effectiveness of the seal is beyond question.

The size of a cavern does not depend on the size of a natural structure as does the size of a pore storage. Less land is required for the same capacity, so the storage right acquirement problem is less serious. The storage company can usually buy enough land in fee without spending too much money. A few hundred acres should be plenty. Cavern storage requires practically no cushion gas. It can provide great flexibility more readily than pore storage. The storage can be made of several rooms which can be manifolded separately into the compressor station. Certain rooms or combinations thereof can be kept for high pressure gas for emergencies and extreme winter peaks. The other rooms can be used for the ordinary warehousing of gas during the not-so-extreme peaks.

Cavern costs — Cavern storage costs are in the neighborhood of $4 or $5 per Mcf of capacity for mined caverns and half that for caverns dissolved in salt. The in-and-out cost of storing each Mcf of gas will be as low as for pore storage, depending again upon how fast the investment is to be charged off. Two or three years should see the first storage accomplished in a cavern.

Dissolved salt storage — Since 1948, something over 13 million bbl of storage for liquid hydrocarbons have been dissolved in the salt domes of the Gulf Coast and the rock salt beds of the Southwest, the Midwest, and the northern Appalachian area. Doubtless, such dissolved caverns would be excellent for gas storage, but all the known satisfactory rock salt areas have lower-cost pore storage possibilities.

Depths

Both pore and cavern storages are most satisfactory from 1000- to 2500-ft depths. At these depths, the pressures are great enough that much gas can be held in a small space, and the storage's delivery capacity is ample with a reasonable number of wells and a reasonable quantity of cushion gas.

Choice of types

If we add the costs of the types of underground storage to the costs of the necessary accessory pipelines, we find that most of the larger space-heating markets in the United States can be most economically served by pore storage. Elsewhere, e.g., in the northern Great Lakes and New England areas, the cavern storage looks to be best.

Pore storage, where it can be used, is much cheaper than cavern storage but the cost of an extra 50 miles of pipeline through a densely populated area may even up the difference. Other cost-influencing factors are the difficulty in acquiring storage rights in populous areas, the difficulties of field operations in populous areas, and the legal and political blocks the local citizenry sometimes erect when they learn that a large-scale industrial plant is going to be installed in the community. On several of these counts the cavern storage comes out ahead, so that it may even be cheaper than pore storage in spite of the cheaper first cost of the pore storage. The cavern may also be as quick to get into operation.

The exploration for pore storage properly starts with a search of published literature and private files and perhaps field reconnaissance to locate a closed anticline if possible. In some areas, the water-well records may show the presence of such a structure.

The next step in the search may be the use of geophysics such as the magnetometer, gravity meter, or seismograph to confirm and to delimit any structures suggested or found in the literature search or perhaps to find previously unknown structures.

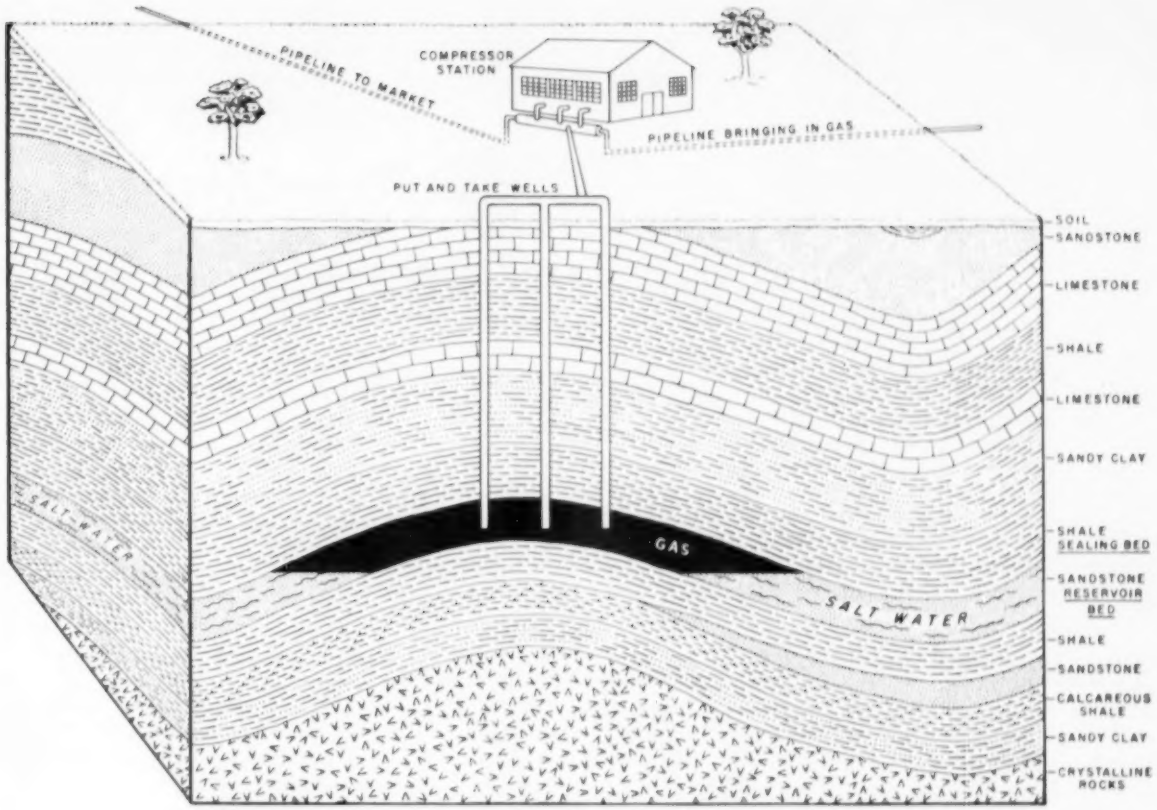
None of the geophysical tools is as accurate as we wish, so the next step probably is the drilling of a series of holes to a shallow but easily recognized "marker" bed where previous work suggests the most likely storage spot to be. In most places the marker bed conforms with or "parallels" the underlying beds so that a dome on a marker bed a few hundred feet down offers a clue to a dome in beds deep enough for storage. As many as 100 shallow holes may be necessary or as few as 30 or 40 might do the job.

Search for reservoir

Assuming that we now have the structure known and fairly well mapped, we start next to test for a reservoir and cap combination. The next step is the drilling of deeper, larger diameter holes, taking cores and samples of reservoir fluids, and logging carefully to determine just where the favorable combinations of cap rock and reservoir bed are. Each hole can cost nearly $100,000; probably 6 to 10 of them will give us the answers we need.

Careful analysis of the cores, actual rock samples, gives the basic information for calculations to determine how a prospective reservoir will take and deliver gas. These data may be supplemented by fluid tests in which water or perhaps even inert gases are pumped into or out of the reservoir while careful measurements are taken as to flow rate and reservoir pressure behavior. If we have found no good reservoir under a good cap rock, we must then look elsewhere; we have really drilled a "dry hole."

The exploration for cavern stor-



Underground pore storage in a water-bearing sand stone reservoir bed on an anticline.

age may be more simple. The first step, as for pore storage, is a search of the literature and other records to determine, as well as we can, the characteristics of the rocks in the area where storage is needed. Almost certainly the information obtained from such a search must be supplemented by drilling with coring machines to obtain rock samples. With careful laboratory work and hole logging, the type and condition of rocks at various depths can be determined with accuracy, so that the mining operation can be largely designed in advance of its actual start.

It may be feasible here, too, to use geophysics to find masses of the best rocks. The geophysics might reduce the amount of drilling required, but in any event some drilling is necessary.

The exploration for either pore or cavern storage might be done in a year, although it might take two.

Development

When we know that the structure will hold and deliver gas, the remainder of the storage rights should be acquired. In some states, eminent domain laws can facilitate the acquisition; in other states, such laws may make the acquisition more certain, but probably not much quicker.

After storage rights have been obtained is the time to go to whatever commissions will regulate the storage to obtain whatever legal certificates may be required. In some states, commission approval must precede the exercise of eminent domain.

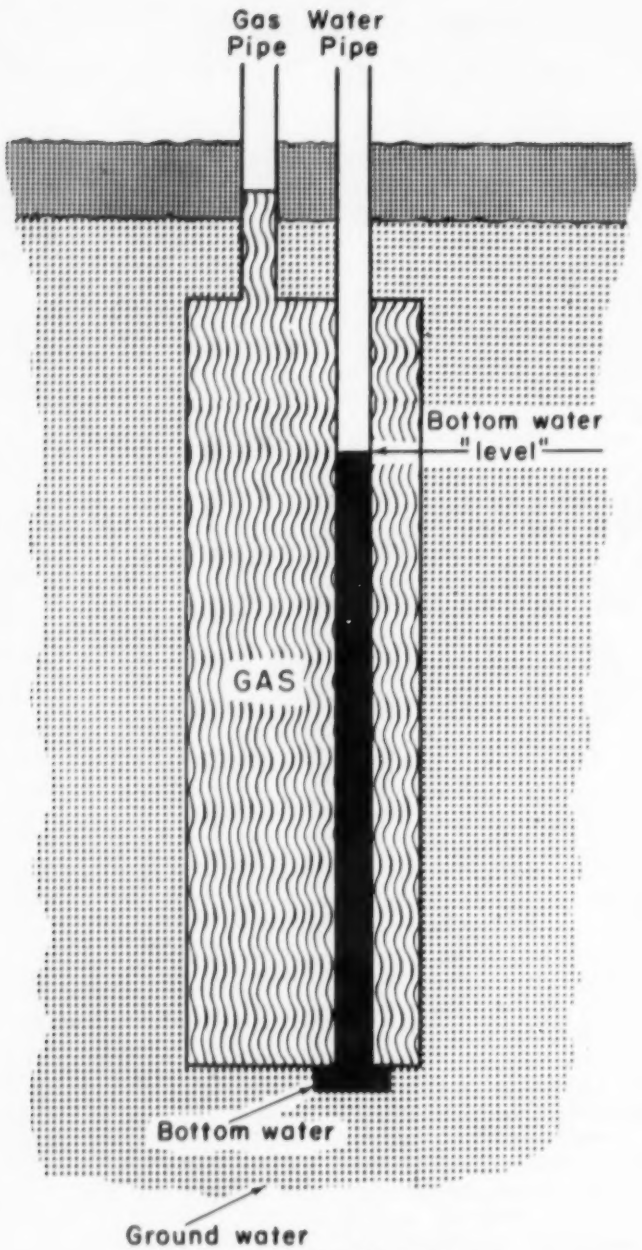
Several more gas wells and observation wells to the reservoir will probably have to be drilled and completed. At the same time, the rest of the service facilities, compressor station, dehydration plant, and a delivery line big enough to hold some line pack, needs to be installed and tested, as does the supply line from the utility system or transmission pipeline.

The development of a pore storage is partly a continuation of the exploration. Every well drilled and every flow of gas or water in or out of the reservoir furnishes new data.

The next step is to find the gas and start filling the storage.

Cavern storage — With cavern storage the work really just starts when the exploration finishes. A shaft or shafts must be sunk to or below the storage depths, drifts and rooms must be opened, wells must be drilled or conduits laid into the rooms, and the rooms sealed off from the drifts. The mine can be planned and designed so that any one or any number of rooms can be tested and put into operation separately. The first few rooms or units can start operating while the mining continues in others.

Since the mine can be on relatively few acres, storage rights should be easier to acquire than with pore storage, and the gathering system of surface lines to the compressor station can be shorter and more compact. No dehydration equipment is needed with a mechanically sealed cavern.



Diagrammatic sketch of an Edholm container.

The cavern can be designed and mined as big as is necessary. The pore storage has to be taken and used as found. However, in many pore storages additional reservoirs exist above or below the first one used so that by the time the first reservoir is full, new wells and a gathering system to the second one can be ready to use. Similarly in a cavern, using the same shafts, additional rooms can be opened above or below those first used.

With both types a limit is reached when all the reservoirs are used or the economics argue against going deeper in a cavern, and additional storage means a renewal of the exploration.

Operation

For prudent operation with either type of underground storage, several precautions should be taken, including the drilling of plenty of observation wells. Such wells bottomed in a porous reservoir outside the gas bubble area give valuable data on the reservoir conditions and the movement of the fluids in the reservoir. Wells bottomed in overlying porous zones and in fractured zones near the cavern inform the operator about the effects of his reservoir pressure changes, information he must have.

Organization

Several pipeline and utility systems in the last few years have set up separate companies for their storages. This separate company method may have advantages. A storage company is not so definitely a public utility, and regulatory commissions may be a little more lenient on earnings. It can make money for the parent company and still make a profit itself, and of course be taxed separately. For administrative reasons, there may be advantages in a separate company; the problems of operating the storage and the necessary personnel are unique, much different from the problems and personnel of a pipeline or gas utility. Such a staff, which will include people with geological and reservoir engineering backgrounds, may work best under its own headquarters rather than under an engineering supervisor without the training to understand and decide on storage problems.

Storage, a blessing

Underground storages are very workable, practically and economically. With adequate storage a utility need sell nothing but household gas if it so chooses. It need buy nothing but commodity gas from its pipeline supplier. The pipeline supplier is operating his plant at 100% load factor the year round. Both of them have insurance against interruptions in the gas supply. The integrated system with storage wastes little or no gas at the field end and can drain its source fields at the most advantageous rate. Adequate storage is the one thing that really turns the overall system — supplier, transmitter, and utility — into an integrated whole. ■

Implementing the automation of gas pipelines

The goal for any natural gas pipeline should be automatic and largely unattended operation. One big pitfall in the rush to get on the automation bandwagon has been a tendency to install automatic equipment to handle a phase of the operation that will not fit into an overall picture as the system is overhauled. In this article, the authors take a good look at the planning that is required.

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and

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(Editor's note: This is the final installment of a two-part series on automatic control in the gas industry. In the first installment, which appeared in the July 1956 issue of GAS, the authors discussed the responsibility of communications in the automation of gas pipelines. These articles are based on remarks made by the authors at the American Gas Association gas supply, transmission, and storage conference May 10-11 in Chicago.)

MEANS are now at hand for the gas transmission industry to reduce operating costs, improve efficiency and service, enhance dependability and safety, and increase the yield on investment dollars. The key to these improvements lies in better use of communication facilities, telemetering, automatic computation, and remote control. It is no longer possible to cling to sweeping arguments that all available components needed for automation are "undependable," nor does the "cost" barrier stand up to critical examination. The simple facts are that most data reporting, monitoring, sensing, computing, and closed-loop regulating functions can be performed much more quickly, accurately and reliably by available mechanical and electrical devices than by human beings.

Competitive methods of producing and marketing energy for the consumer are receiving concentrated attention directed toward reduction of cost. The same economic pressures which are forcing other industries toward automation are beginning to be felt in the gas industry. Limited installations of automatically and remotely controlled pumping stations have already been made in both gas and petroleum product pipelines.

Automation is by now an accepted way of industrial life. But an important point which seems to have been neglected in many attempts at limited remote control and telemetering installations in the gas industry is the system planning aspect. Every step toward automation should fit into a final plan and an ultimate goal, thus avoiding obsolescence of equipment.

In the gas pipeline industry today one finds that tremendous installations, representing large investments, are in many cases under the operational control of data-handling and monitoring systems which are obsolete by modern technological standards. Millions of dollars of investment in private

communication facilities are being utilized by the gas transmission industry at only a fraction of their capabilities. Lack of automatic monitoring and control of critical parameters leads to unnecessary risks of service disruption. Data concerning pressures, temperatures, compressors in service, speeds, total input flow, and major load demands are delayed in utilization—in some cases for many hours. Much of the basic control data is periodically read by eye, transmitted by voice, and recorded by hand—later to be acted upon by human judgment entirely. Such methods are unnecessarily labor and time consuming, and are subject to human error at every point in the process. In many systems there is not even a centralized control point at each pumping station where all critical factors concerning station operation can be evaluated.

Automatic and largely unattended operation is the not-too-far-distant goal for natural gas pipeline. There is no time to be wasted in making system plans leading up to this ultimate goal. Of course some standby and maintenance personnel will still be required even in an ultimate system, but all of the routine jobs can be done more efficiently and at less cost by automatic methods. It is not difficult to see how the efficiency of labor forces on long-haul pipelines can be improved appreciably through proper planning and installation of modern equipment. For example, most of the routine data-handling, monitoring, and control functions performed by automatic equipment tend to improve operating conditions and reduce operating personnel requirements, while allowing major maintenance and overhaul work to be handled by mobile crews. The annual net savings involved in such a shifting and retraining of the labor force must remain for management to evaluate. Large sums are at stake, however, and the whole matter deserves serious study by all segments of the industry—particularly by the communications section.

The trend toward automation in most industries has been an evolutionary process, but the pace has accelerated greatly in the past few years. This gradual development has been the result of the fact that suitable components were frequently not available, thus delaying the entire process. This is not the case today in the gas industry, however, and there is no technological barrier to automation. A wealth of equipment and components is now available for immediate use in automatic systems, as has been pointed out. One note of caution should be injected here. In the rush to get on the bandwagon it is entirely possible to install remote control and data handling equipment which does a limited job now but which fits poorly into an ultimate plan for automatic control of the system. The only preventative for this situation is to do a competent and adequate long-range planning job *before* any equipment is installed.

Goal not distant

Logical steps toward automation in a gas transmission system are as follows:

1. *Addition* of automatic data-handling and telemetering equipment to existing communication facilities where they are adequate; renovating for this automatic communications equipment where necessary.
2. *Centralization* of monitoring and control at each pumping station as a correlative of 1.
3. *Extension* of monitoring, automatic alarm, and local closed-loop control functions to minimize the human element at mainline pumping stations; extension of data reporting to include totalized input flow and major load demands.
4. *Installation* of supervisory control elements arranged to provide remote control of pumping stations from dispatching headquarters.
5. *Provision* for automatic computation of optimum pressures along the entire line for existing input and load conditions as well as anticipatory factors of demand, supply, and weather.
6. *Final* closing of the control loop between mainline pumping stations and dispatching headquarters through automatic utilization of the computations in 5.

The exact order and the rapidity of application of these steps in a given system would naturally vary somewhat, depending on presently installed equipment, operational history, size of the system, etc. However, excessive variation and time delay must be avoided if one is to escape the confusion that results from operation of too many systems within a system. In some rare instances, it may even be advantageous to carry through a partial system installation on one station as soon as possible, following with the step-by-step approach at a later date. The case where this approach could be advantageous, however, will be extremely rare.

Techniques available

A wide variety of techniques and equipment, using both digital and analog techniques, is now available for automatic data handling and remote control. Much of this technology has been developed, at great expense, for use in such fields as guided missiles, business data processing, integrated weather reporting, and air traffic control. Various telemetering systems for pressures, temperatures, and flow rates have been developed specifically for application in the utility industries. The results of all this effort are available today in the form of reliable components and devices of many types which are in production. Combinations for specific system needs, drawing upon available equipment, can readily be made. The choice of methods and combinations for a given system will depend on many factors, such as the amount of data to be handled, speed required, equipment already installed, history and method of operation, rate of change and predictability of input information.

The rate of data transmission normally required in gas pipeline or distribution systems is relatively low as compared, for example, with the requirements for telemetering in guided missile work. The equipment can therefore be considerably simpler and the bandwidths narrower than are necessary in high-speed telemetering. The principle of multiplexing can be used extensively to conserve channel bandwidths and equipment.

Considerable progress has already been made in the develop-

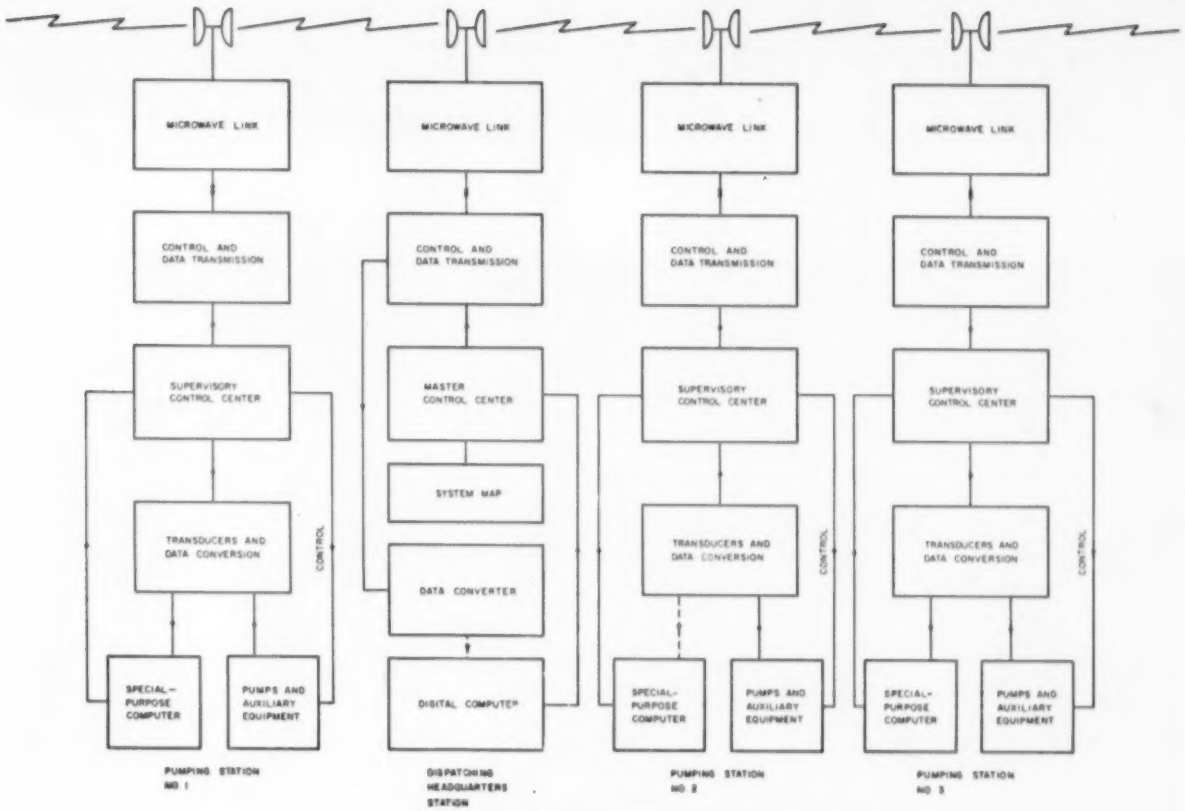

Fig. 1. System block diagram: data handling and control.

ment of components designed specifically for automatic operation in pipeline pumping stations. These include, of course, remote-controlled valves, sequential programmed controls for pumps and auxiliaries, automatic safety and limit devices, etc. Complete control systems have been engineered for starting and stopping large gas turbine-driven centrifugal compressors with a single "start" or "stop" command, including the control of all auxiliaries and necessary valve operations. Similar control systems for engine-driven compressor stations are now in operation. Completely automatic pumping stations are now being operated in both gas and petroleum product pipelines. The application of unified speed controls in parallel-operated compressor stations, with closed-loop control of compressor speed to maintain desired station discharge pressure, is entirely feasible. In short, there is no real technological limit to problems of this type that can be solved by intelligent application of known techniques and equipment.

First steps

A typical long-line gas transmission system is chosen as an example to illustrate what can be done immediately with existing techniques to implement the trend toward automatic control. This pipeline has its own microwave communication system, representing an investment of millions of dollars. While this equipment successfully handles voice communication along the line, it operates with most of the deficiencies previously mentioned. Data and important orders must be handled by voice, and are subject to human error at every point in the transmission and transcribing process. The effects of inefficient use of personnel, lack of automatic monitoring facilities, and lack of central supervisory control are all being felt, directly and indirectly in increased operating costs and unnecessary risks of service disruption. Meanwhile the microwave link, which has a tremendous capacity for handling data and remote control information, is being used to a small fraction of its capacity. There is no way of rapidly transmitting written orders to and from stations on the line and/or the dispatching headquarters.

The above situation can be greatly improved at once by the installation of automatic data handling and monitoring equipment as first steps in a comprehensive program designed for ultimate completely automatic operation. Taking into account all the pertinent factors, including the type and quantity of data to be transmitted, size of the system, speed, accuracy and reliability required of the data handling and remote control features, one of several possible solutions to the problem of our typical long line could be based on the following principles:

1. A digital data transmission system should be set up for the handling and recording of data,

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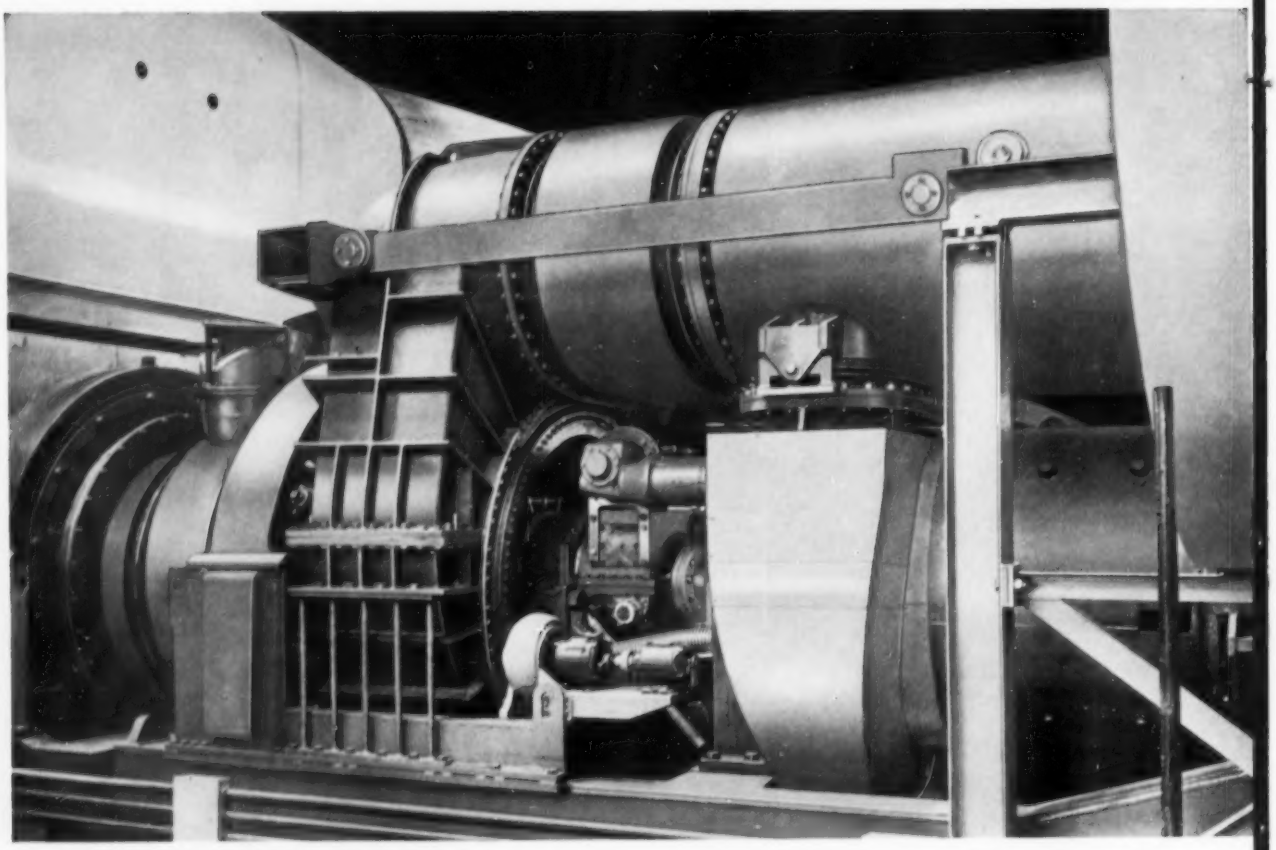

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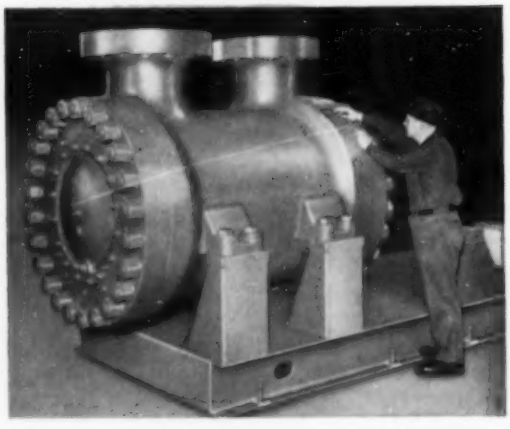

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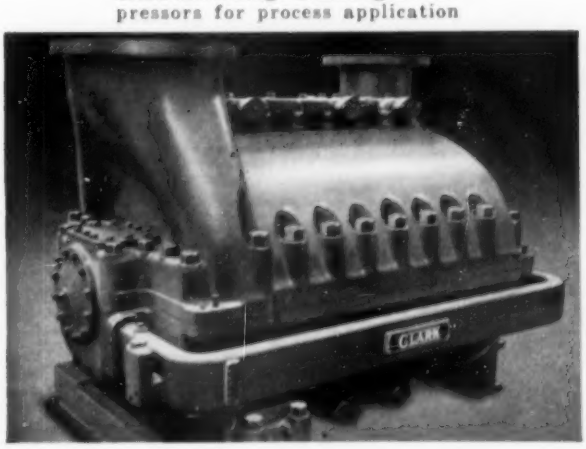

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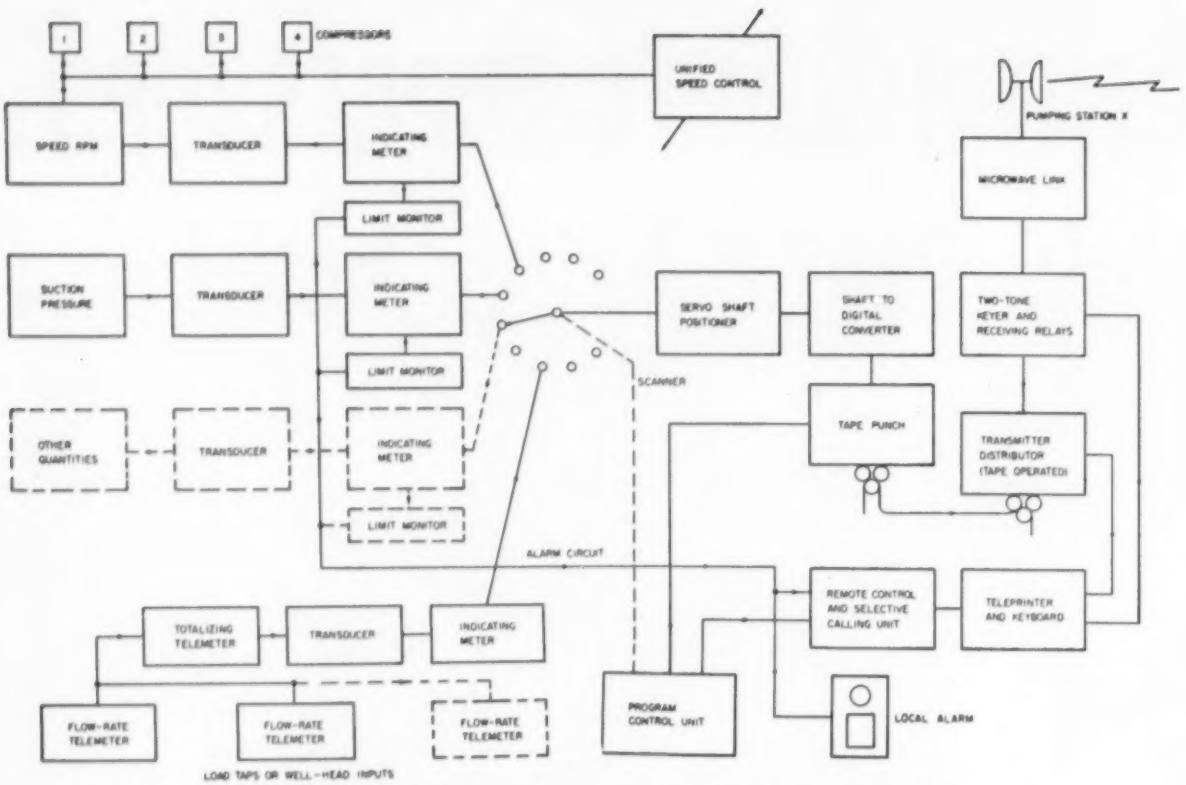

Fig. 2 Data handling and control equipment at a typical pumping station.

using the existing microwave link as the transmission medium. Printing telegraph equipment with suitable auxiliary data gathering and storage devices would be used for automatic data logging, and would be available for printed message copy a large part of the time. A small portion of one voice channel bandwidth would be needed only part of the time for this function. All other voice channels would remain undisturbed and could be used continuously for other purposes.

2. Data read-out should be accomplished automatically in printed form at any desired interval, and at any points desired along the entire pipeline; for example, the dispatcher's office and the opposite terminus.

3. Conversion of pressures, temperatures, flow rates, power consumption, and other quantities into digital form should be accomplished automatically at each station, with no attention required of local pumping station personnel for routine data reporting.

4. Programming of the entire data read-out process should likewise be completely automatic, and should be under the control of a master clock set for the desired interval of read-out.

5. The dispatcher or dispatch computers should be able in addition to interrogate any station at any time in order to obtain a special read-out of data from that station. Voice communications with the station would of course be possible at all times.

6. The printing telegraph equipment would be available more than 90 per cent of the time for the transmission of command orders from dispatching headquarters to any or all stations on the line, and for two-way transmission between a station and any other station.

7. In addition to being printed out on prepared forms, the digital data could be read out simultaneously in punched card or punched tape for immediate use by a digital computer in calculating line-pack and efficiency factors, and for computing optimum pressures at all points along the line under existing operating conditions.

8. Transmission of flow-rate data from major load delivery points and well-head input points should be handled in two steps. First, the data should be telemetered over any available communication line (leased or private) from metering points in the gas fields or consumer areas to the nearest main pumping station. Second, this data should be converted to digital form like other data at the pumping station and transmitted to dispatching headquarters and other points as required.

Supervisory control and monitoring

1. A central supervisory control point in each pumping station should be established. At a central desk, the shift engineer can then read all important temperatures, pressures, flow-rates, power consumption, and other quantities. Centralized control, including unified speed control of

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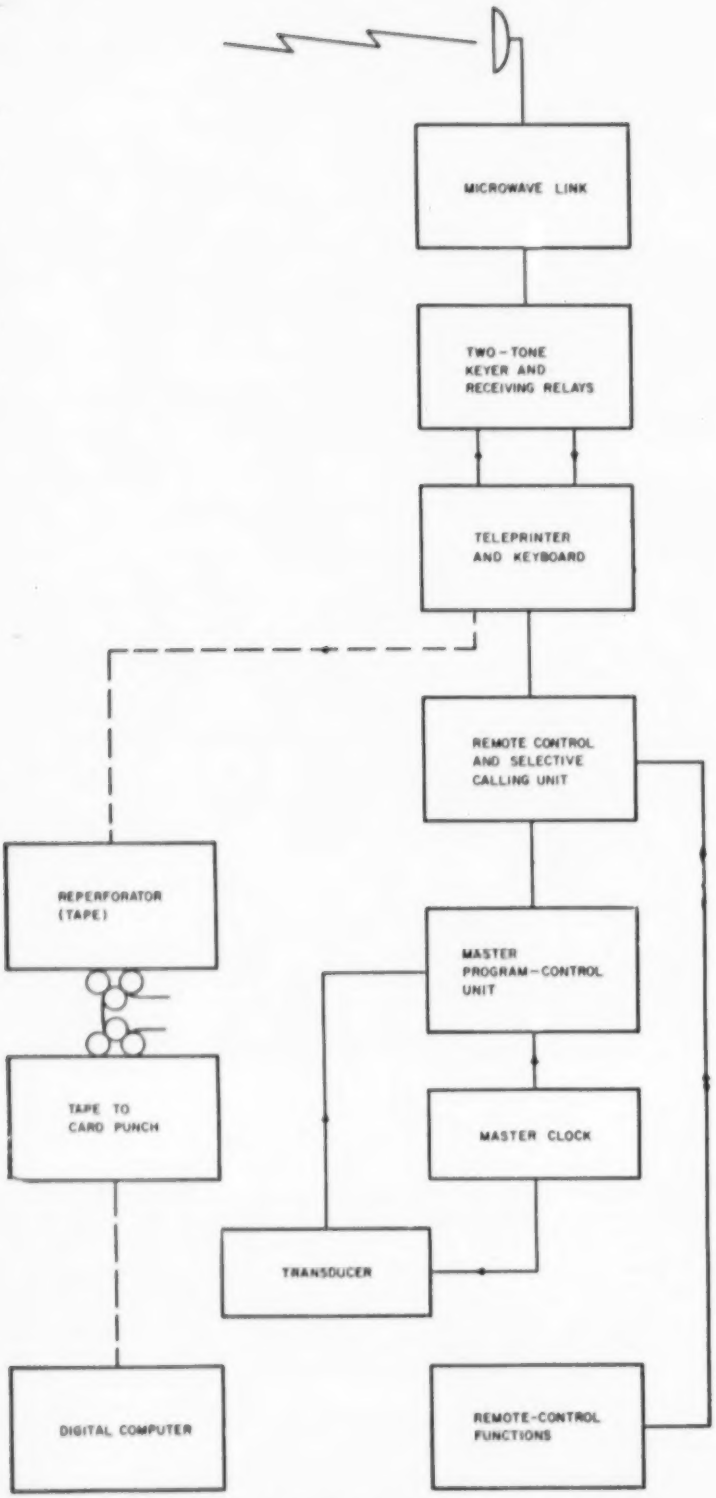

Fig. 3. Data handling and control equipment at dispatching headquarters.

compressors, would be installed at this point.

2. *Automatic* alarm circuits would be set up at each station to monitor a number of critical quantities, such as suction and discharge pressure, compressor speed, etc. Limits for the various quantities would be adjustable, but once set, an alarm would sound locally in the pumping station and at the dispatcher's office in the event that any quantity exceeded the limits set for it. This would call immediate attention to impending trouble at the earliest possible moment, and would be a positive factor in helping to maintain continuity of service.

3. *Additions* and changes would be made at dispatching headquarters for better surveillance and monitoring of pipeline operation. Automatic logging equipment would take care of the routine recording of data automatically, at regular intervals. Alarm circuits would call immediate attention to abnormal conditions at any point on the line. A graphic control board and system map would show the status of all pumping stations, major input points, and load taps at a glance. The dispatcher would thus be relieved of routine duties and could devote more attention to the determination of optimum conditions on the line under given conditions — assisted in routine line handling by a computer. Special data read-outs from any station could be obtained in a matter of seconds at his request.

The above steps are essentials in the complete automation of a gas transmission system and they are important, because of the immediate direct benefits they can bring in terms of reduced cost and improved reliability. Extensions of the monitoring and alarm functions must be made, to replace the variable and approximate ability of human beings to check on temperatures, vibration, noise levels, and other factors in various parts of the pumping station. Closed-loop controls must be added to maintain assigned discharge pressure at the station automatically through compressor speed control.

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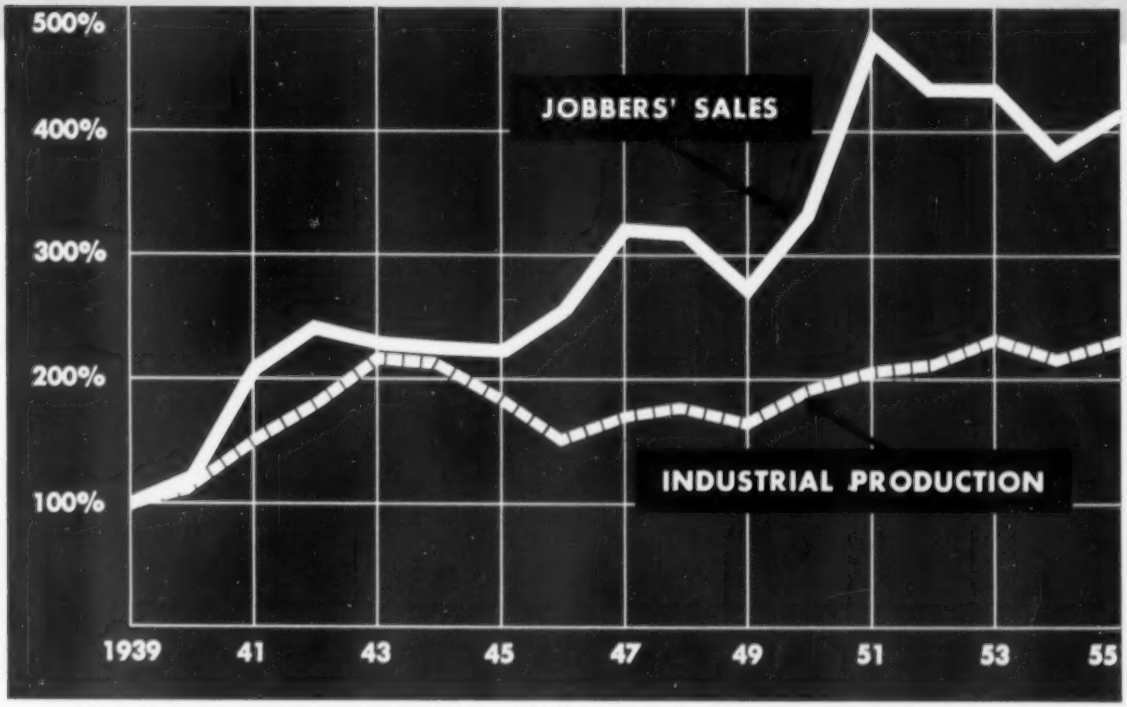

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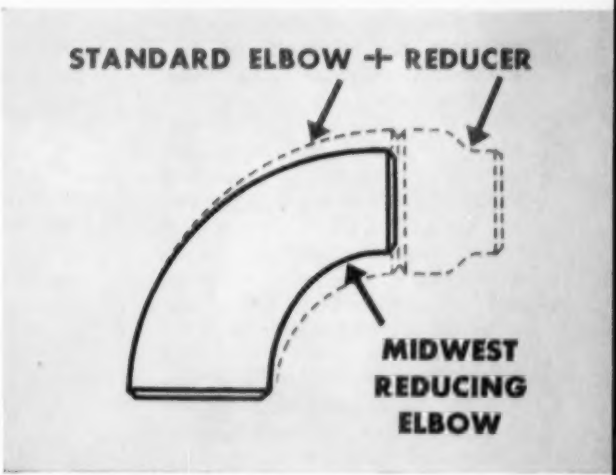

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Programmed sequences must automatically handle the auxiliaries in starting or stopping compressors. Remote control of pumping stations from dispatching headquarters should be installed. A centralized computer should calculate optimum conditions for the entire pipeline, basing its conclusions on the following factors:

1. Anticipated loads.
2. Weather conditions and predictions.
3. Local line conditions; maintenance situation, etc.
4. Total input to line.
5. Efficiency factors.
6. Temperature.
7. Specific gravity.
8. Existing line pack.

Closed-loop control, maintaining the computed optimum line conditions automatically, is the most crucial step in automatizing a gas transmission system and must be the predominant factor in all system modification considerations.

Data reporting

A brief look at the kind of equipment required to accomplish the first two steps toward automatic operation on a long-haul pipeline is worthwhile at this point. The particular solution suggested here is only one of many possibilities that could be considered. *Fig. 1* is a block diagram of the data-handling and control equipment in the system. This is shown in more detail in *Fig. 2*, for equipment at a typical pumping station, and in *Fig. 3*, for equipment at dispatching headquarters.

Each pumping station should have the following equipment installed for centralized control and automatic data handling:

Automatic equipment

1. A supervisory control desk, including: indicating meters; alarm set limits and alarm unit; unified compressor speed control; weather coder; telephones; shaft-to-digital converters; tape punch, and program control unit.

2. Automatic printing telegraph equipment, including page printer and keyboard in a nearby console.

3. Suitable transducers and remote control circuitry at appropriate points in the pumping station so that the central supervisory indications are provided, and the desired central controls are available.

At dispatching headquarters, the new equipment is of a somewhat different nature, and includes the following:

1. A special supervisory console containing: master clock; master program control unit; alarm unit; remote controls which can be connected to any pumping station as desired for requesting special data read-out, control of compressor speed, etc.; telephones and microwave channel switchboard, and controls for selective calling of stations, with connections for printing telegraph system.

2. A graphic system map control board showing: all pumping stations; all major wellheads and producer feed points; all important load taps and terminating points, and lamps at each station, indicating by colored lights whether that station now has normal conditions, abnormal or alarm conditions, or is now reporting data.

3. Automatic printing telegraph equipment, including page printer and keyboard in a nearby console. Reperforator (tape) may be included if data are to be simultaneously recorded for input to a computer.

It will be noted that provision has been made for consoles at dispatching headquarters and main-line pumping stations. These will serve as a means for human monitoring of the data logging and control system by one man at each station.

The detailed sequence of automatic operations in the read-out of data with the equipment described above is outlined in *Table 1*. The cost of equipment of this type depends, of course, on the particular system and the degree of automatically incorporated. It is dangerous to generalize here, but it is virtually certain that a great deal could be done toward automatizing the data handling process, for example, with the annual cost of a couple of men at each pumping station. In other words, the costs for capital equipment are not as large as one might think. It is recognized that operating costs are viewed in a different light than

TABLE I PROPOSED SEQUENCE OF AUTOMATIC OPERATIONS IN READOUT OF DATA FOR POSSIBLE SYSTEM SHOWN IN FIGS. 1, 2, and 3.

1. About 30 seconds prior to each scheduled reporting period (or on initiation of the dispatcher at any other time), a "preparation signal" is sent through the teleprinter circuit to all main-line pumping stations.

2. A local program control unit at each station will then interrogate all transducers in sequence. The data will be read out of the transducers in the form of digital teleprinter code and stored temporarily on punched paper tape. This operation may require about 15 seconds, and will be entirely automatic.

3. On receipt of the "read-out signal" from headquarters for that particular pumping station, the tape will be run automatically through the transmitter-distributor. This will cause the data to be printed out automatically at one or more receiving points at the rate of about five characters per second.

4. The preparation signal and the read-out signal will be controlled and initiated by a master clock and master program control unit at the headquarters station—again with no attention required by any operating personnel.

5. The automatic interrogation of each pumping station in sequence for read-out of data will also be controlled by the master program control unit at dispatching headquarters.

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capital investment, and that taxes affect the overall picture. No outside organization can tell any operating gas transmission company exactly how soon and how much money can be saved through installation of automatic data handling equipment or any other steps toward automation. It is up to the managements of these companies to examine their own operations critically, from the long range cost viewpoint, and make their own decisions. Consulting assistance from an unbiased and impartial engineering firm, familiar with data handling and remote control techniques, will be very helpful in preparing a truly long-range plan and implementing it with the best equipment available.

Management, operations, communications, and maintenance personnel all have an important part in overall decisions concerning trends toward automation in gas pipelining. It is only through communications channels that these steps can be implemented, and it is therefore the responsibility of communications personnel, as much as any other group, to realize the possibilities in automation, do the necessary initial system thinking, and keep their managements fully informed. The gas pipeline industry has done a tremendous job in getting where it is, but it can't stand still. Other competing forms of energy are going forward rapidly in utilizing advanced technology to reduce operating costs. Much can be done in the gas pipeline industry to save money, while at the same time improving the safety and dependability of service. There is no one technical answer for all systems, but there is an almost unlimited supply of existing equipment and technology available for immediate use. Each system requires an intelligent engineering study and considerable planning before equipment is actually procured. Each step in the process must be part of an overall advance plan, leading toward the eventual goal of automatic operation. We have discussed a typical example only to show a type of solution that is possible today. Many minor variations to suit individual needs, present equipment, and past operational history must be expected. ■

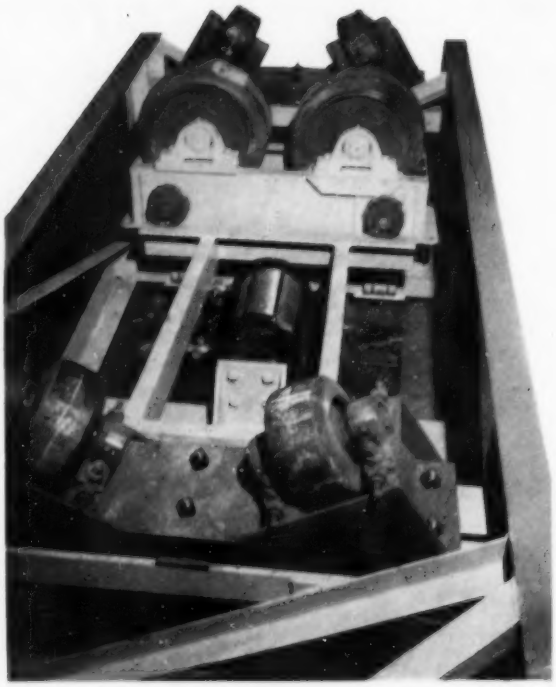

Fig. 1. A section of pipe handling rack designed to lift, rotate, and convey double jointed 40-ft lengths of 30-in. steel pipe for automatic welding operations. Air cylinder in center provides lift.

Bechtel uses automatic welding to double joint on Westcoast's pipeline

TRENCHING machines are clanking, tractor cleats are cutting in, and welding sparks are flying in Canada now that pipelining is underway on Westcoast Transmission Co.'s new line that will bring Peace River natural gas to the U. S.-Canadian border at the state of Washington. The pipeline—650 miles of 30-in. OD steel pipe from the Fort St. John area to Huntington, at the northern border of Washington—will supply Canadian distribution companies and export gas to the U. S. via connection with the Pacific Northwest Scenic Inch pipeline.

Canadian Bechtel Ltd. has its construction division hard at work on a 210-mile segment of the Westcoast line, north and south of the city of Prince George. Other schedules of the line are being built by various pipeline contractors under supervision of the management division of Canadian Bechtel.

Construction division is using unique mechanisms for double jointing 40-ft random lengths of pipe into 80-ft joints. This work is being done at several strategically located points equipped to produce consistent, high quality welds. Mechanical pipe handling facilities and automatic welding machines enable these yards to have efficient, production-line type operation.

The double jointing is done in three welding operations. First, two 40-ft lengths of pipe are

aligned for welding on a special rack (see *Fig. 1*). A welder then manually applies the stringer bead. The stringer-jointed 80-ft length of pipe then moves mechanically to a second rack equipped with three sets of rollers driven by an air motor under variable speed control. As the rack rotates the pipe at the proper welding speed, a hot-pass welder manually runs-on his work. The 80-ft pipe length is next conveyed to another rack with four rollers similarly powered (*Fig. 2*).

An automatic, submerged-arc welding machine then moves into action to apply the finishing passes as the pipe is rotated. The welding head operates with twin reels of welding wire and is powered from two 600-amp generators (*Fig. 3*). The system operates at a rate of eight finished welds an hour—16 40-ft lengths are double jointed to eight 80-ft lengths each hour. Each weld is radiographed before stringing trucks pick up the pipe to deliver it to the right-of-way.

Advantages from the establishment of these double jointing yards are:

(1) *Special* equipment handles pipe more efficiently.

(2) *Automatic* welding is more closely controlled and is faster than manual field work—a better weld is produced consistently.

(3) *Less* field welding and pipe laying have to be done by the spread.

(4) *Shelter* at the double jointing yards mean work can continue during weather that would slow or stop field work.

As they make pipeline, Bechtel plans to establish four double-jointing locations. Each, in turn, will use the same equipment. Three of the yards will serve respective 30-mile sections of the pipeline. Trucks will make maximum trips of 15 miles (either north or south of the yard) to the right-of-way. The fourth yard will be at the terminal point (Prince George) for the railroad delivering the pipe. Trucks will have to make maximum trips of about 100 miles in this case.

Bechtel is scheduled to complete construction on its part of the Westcoast line by September, 1957. ■

Fig. 2. Full view of a four roller section. Larger sets of wheels lift and rotate pipe. Smaller, canted wheel sets provide mobility for the pipe and aid rotation. This 90-ft long section is the center part of the 170-ft over-all pipe handling unit.

Fig. 3. This double jointed section has had the stringer bead and hot pass welds made. Here, an automatic welding head is being adjusted to apply required filler passes.

GAS staff report

Interior Secretary Seaton describes himself as a "middle-of-the-roader"

By NEIL R. REGEIMBAL,
GAS Washington Bureau

THE new secretary of the interior, Fred A. Seaton, is a one-time amateur boxer who could become one of the gas industry's most useful friends in government—at a time when the industry can use a friend.

The new secretary, shortly after he took office, sat down with GAS at a private interview, and, cheerfully igniting cigarets in rapid fire order, expounded his philosophies. He is a dedicated disciple of his boss, President Eisenhower, and makes no bones about his readiness to do virtually anything the "chief" asks—if he says there's a good reason for it—including "jumping off the top of the Washington monument."

Like President Eisenhower, he is a "middle-of-the-roader, a conservative liberal, or a liberal conservative," but the visitor comes away with the impression that Mr. Seaton always has a pretty good idea of where the middle of the road he's travelling will lead.

He's fresh on the job, and green about details of the myriad responsibilities of the Department of the Interior. He welcomes help, and invites anyone—industry, business, consumer—with an idea to sit down and talk it over. He says he wants ideas, and, within reason, will keep his door open.

He's frank—but smooth as silk. His speedy confirmation by the Senate to a post that has been a political furnace for years has been attributed to the fact that he was a member of the "club" because he served a year in the Senate in 1952 to fill an unexpired term. It's more than likely that his frankness coupled with a native smoothness defanged repeated serious attempts to draw from him statements to be used for political advantage during confirmation hearings.

FRED A. SEATON

On specific gas industry issues, Mr. Seaton is now in a process of "finding out." He was scheduled to meet with Rep. Emanuel Celler (D.—N. Y.) in the last few weeks at Representative Celler's request —to hear the congressman's complaints that the National Petroleum Council and the Military Petroleum Advisory Board are "breeding grounds for violations of the anti-trust laws." The charge is made because the two groups, made up of gas and petroleum industry officials, elect their own chairmen and set their own agendas. Representative Celler says these meetings should be run by full-time government employees.

With knowledge only that "there is such a council," Mr. Seaton says he believes that if the gas-petroleum industry would object so violently to installation of a government official to head the councils that they would lose their strength, then it should not be done. But if the lack of government leadership of the groups distresses enough people ("51%" he says) so that it endangers the work the Eisenhower Administration is trying to accomplish, then the gas industry and the Administration should take that into consideration, and if necessary, back down somewhat.

Asked if he personally favors deregulation of independent gas producers through legislation similar to the Harris bill, Mr. Seaton, in a sentence which may be the tip-off to the possibility of an administration-backed gas bill next year, says that the administration will probably restate its position "that freedom of producers, as well as protection of the public is necessary." If the producers become too greedy, they would have to be curbed, and if the consuming interests become too greedy, that too would require action, he says.

The implication is that rumors that President Eisenhower now favors a type of legislation which

Continued on page 116

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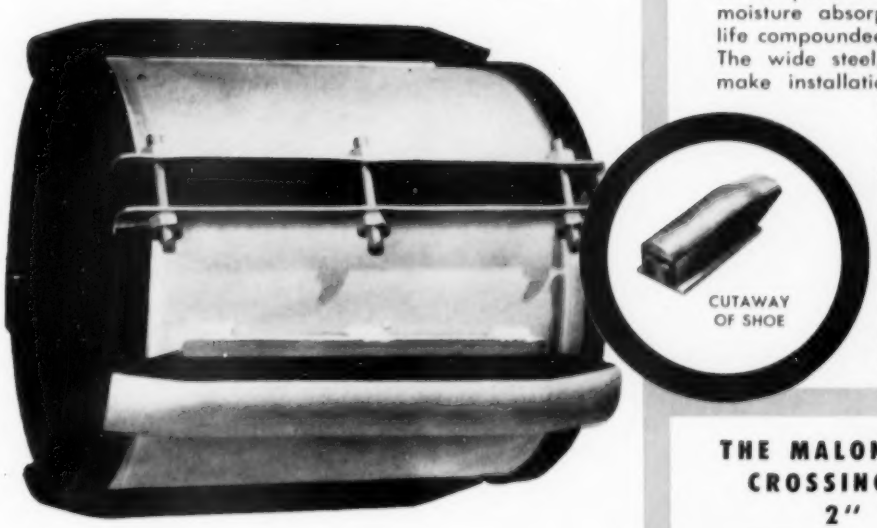

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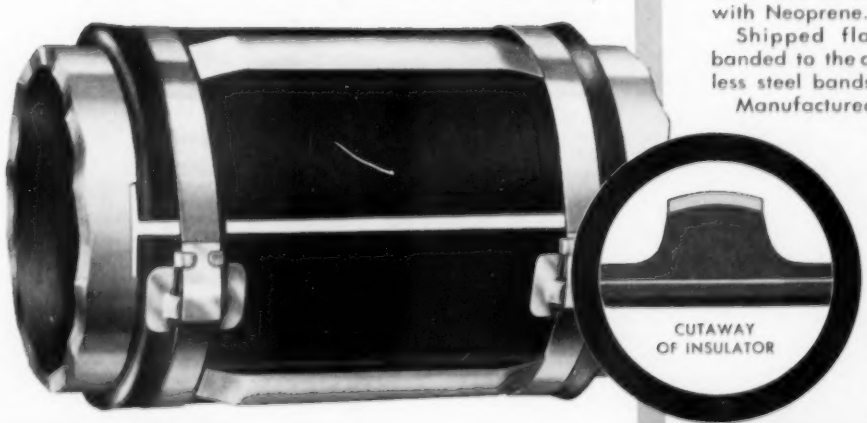

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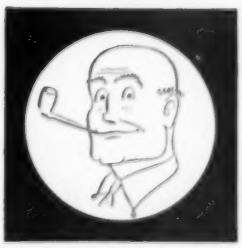

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Continued from page 114

would not free the producers, but would legislatively limit the controls which could be exercised over them and perhaps set up the ground rules for their administration, are well-founded.

Mr. Seaton admits he accepted his present post somewhat reluctantly, not because of any desire to avoid a fight, but because he still wants to get back to his native Kansas and run his string of newspapers, magazines, and broadcasting stations.

He is not only a fighter from childhood days—"I got in too many fights as a kid, and lost too many of them"—but he is probably one of the most skillful politicians around. His philosophy: "I am at an age now where I no longer look for fights, but when the time comes that you can't back up any further, well . . ."

As an accomplished politician, he has little sympathy for anyone who gets burned because of ineptness. Nor does he buy complaints that the gas industry does not have nearly as well-developed a formal, or as he puts it mechanical, channel into the executive branch as do some other industries which operate through the U. S. Commerce Department.

"I don't put much stock in mechanical methods," he says. The gas industry has friends in Congress, and in the White House, and if they want to get a problem to the top, then they should use these channels, is his implied advice.

His support of freedom for business as long as there are no abuses, makes him a potential friend of the gas industry—a friend sitting in a spot which perhaps the industry has not been as close to as it could have been in the past.

Finally, Fred Seaton is a man to watch in Washington. He first came here to fill the vacant Senate seat, then moved over, for a hitch in a trouble-shooting spot in the Defense Department helping bring Germany into the free world military alliance. He was in the White House as a special Presidential assistant working mostly on farm problems, up to his appointment. He has risen fast, and in the coming years, may rise even higher. ■

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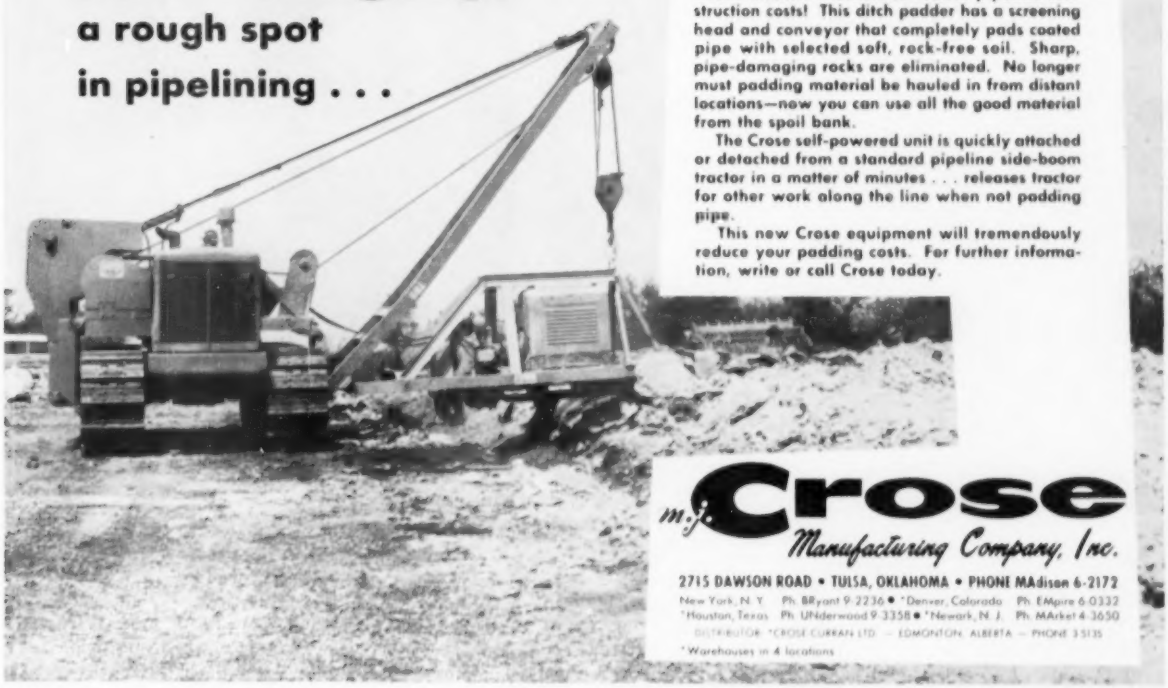

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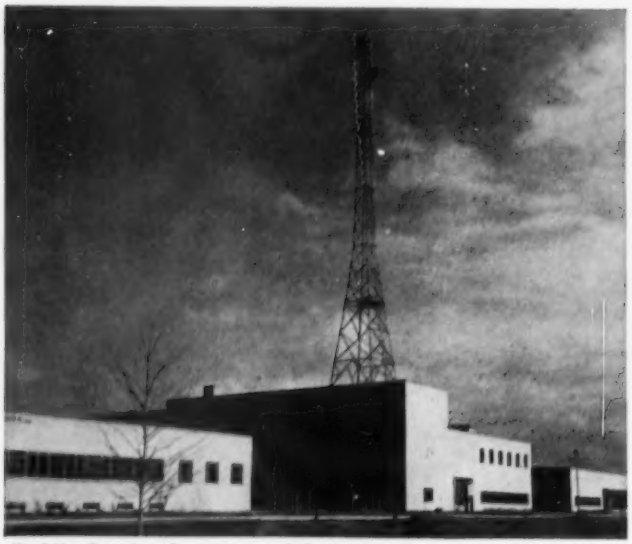

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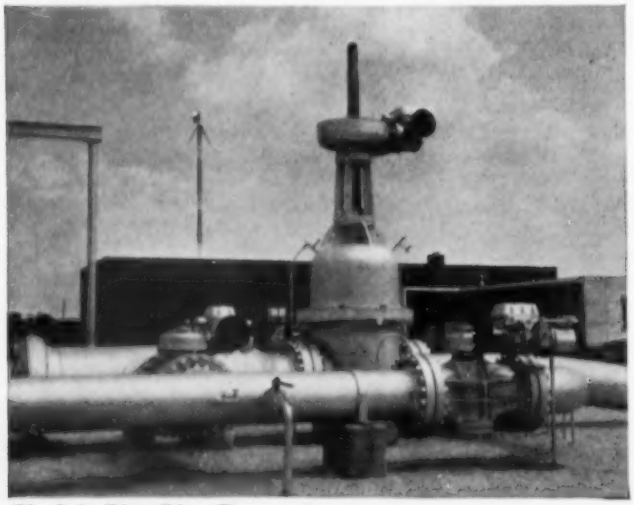

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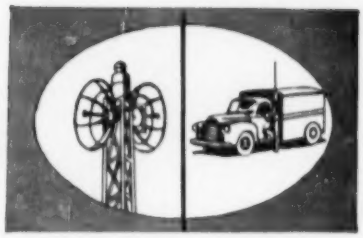

Recent trends in the communications aspects of data processing systems

This column has been adapted from a talk presented by R. C. Matlack, special systems engineer of Bell Telephone Laboratories Inc., at the Petroleum Industry Electrical Association convention held May 1, 1956 in Dallas.

THE emphasis in recent years has been toward the mechanization of what can be referred to as the housekeeping functions of business. These are payroll, inventory, supervisory and production control and similar necessary functions which readily lend themselves to mechanization. Telemetering and supervisory control are included in this broad category.

Data transmission is a necessary part of all these mechanized systems. The speed capability of electronic computers has necessitated the development of new recording methods such as magnetic tape, which, in turn, accentuates the need of higher speed communication systems. The Bell System has had numerous requests from industry to provide high speed data transmission systems. Our data transmission services are presently limited to the familiar slow speed teletypewriter of 60, 75 or 100 words per minute. Various private line channels are now used or are available for data transmission. These consist of voice, 5-, 8- and 15-kilocycle program circuits, and television. In addition the basic 48-and 96-kilocycle channels, which

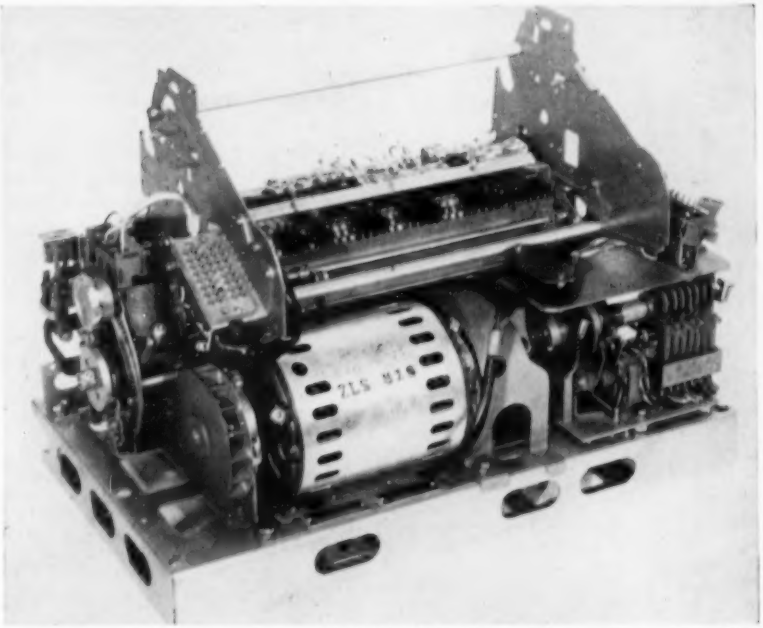

Fig. 1. A stunt box is used when it is desirable to furnish a selective calling system which will function with the older 19-type teletypewriter equipment.

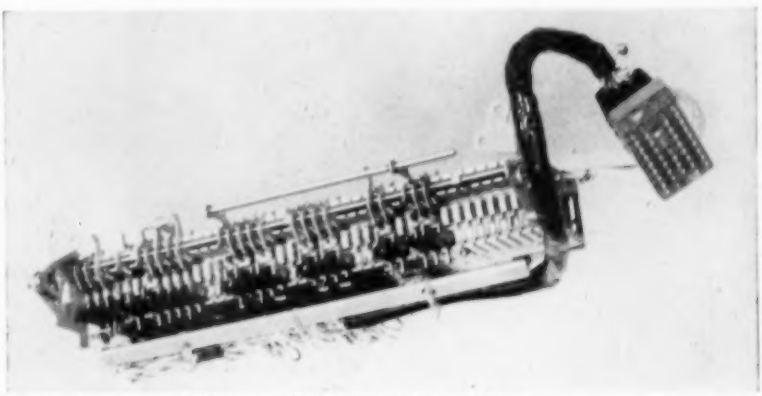

Fig. 2—Upper assembly between the brackets is the stunt box.

Find Out How HEATH SURVEYS

- ✓ locate and classify gas leaks
- ✓ provide thorough check of all areas
- ✓ give you maximum SAFETY

You can't sell gas that leaks out before it reaches the meter.

Write for details about gas conserved by companies using the HEATH SURVEY method.

HEATH
Survey Consultants, Inc.
573 WASHINGTON STREET, WELLESLEY 81, MASS.

presently are subdivided for voice circuits, could be made available for data transmission when a demand exists. We have under development a digital subset which will use a voice channel rather than a telegraph channel and have a capability of approximately 750 bits per second or roughly 1000 words per minute. At the transmitting end, this digital subset will accept serialized dc pulses which will be used to modulate a suitable carrier. At the receiving end, these signals will be demodulated and delivered in the form of serialized dc pulses. The digital subset will also contain the necessary supervisory and control features.

One of our worst enemies in connection with pulse transmission is impulse noise. This type of noise occurs in the telephone plant from such things as lightning and, more commonly, from man-made sources. It is desirable to use transmission techniques that minimize the effects of impulse noise. Such noise impulses, or rather the errors caused by them, give rise to one of the biggest problems in connection with data transmission, particularly where it is used for accounting or telemetering control purposes. In the past, where text type transmission has been the predominant type, accuracy has not been nearly so controlling a factor since the redundancy of the written word is sufficient to allow for occasional errors even though annoying. However, when transmitting digital data without error-detecting schemes, an error can have quite serious consequences.

There are two general approaches to the control of errors in pulse-type transmission. One, the brute force method, is to transmit data twice and make a comparison. This in general is wasteful of bandwidth and time. However, it is used extensively in slow-speed systems where high utilization of the transmission facility is not of prime consideration.

The other general method of controlling errors is to provide sufficient redundancy in the code used so that errors may be detected. The most prevalent use of this type of system is that now practiced by the computer people whereby they use a parity check scheme, which consists of checking a received character for an odd number of marking pulses. If the received number of pulses is anything other than odd, it is known that an error exists. This system protects against single but not against double errors.

At the expense of increasing the redundancy an X out of N code can be used. For example, take the tones used in the setting up of a long distance toll call. Here each digit is represented by two frequencies out of a total of five. These five frequencies, used two at a time, give a total of the 10 possible combinations required for transmitting the decimal telephone numbers. As is readily apparent, this type of system gives additional security against double errors. In the telephone plant, where impulse noise may occur due to switching transients and man-made interference, a highly reliable detecting scheme is desirable. There are two general methods of using an error-detecting code in order to ensure that the character is correctly received.

One of these methods is to put

ON THE JOB CONSTRUCTION

CONCRETE RIVER WEIGHTS

One of the many Edwards Concrete River Weights installations on Texas-Illinois Natural Gas Pipeline.
Edwards Split Welding Sleeves also used on the line to insure perfect joints in swamps, rivers and safety zones.

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SPRINGFIELD GAS LIGHT CO.

STABILIZES BY REMOTE CONTROL

...with Foxboro TELETAX* Telemetering

Here's another modern utility that's assuring highest efficiency in a key operation through Foxboro Teletax Telemetering. Using this advanced supervisory control system, the superintendent at Springfield Gas Light Company's main plant has complete command of gas stabilizing operations at the city gate, three miles away. A B.T.U. Recorder continuously shows him the heating value of the gas; a Teletax Receiver indicates the air/gas ratio being maintained. If gas varies from pre-set B.T.U. value, he pushes a button either to raise or lower air-to-gas ratio and restore proper B.T.U. value.

This is only one of many Teletax installations, specifically engineered to meet a wide variety of requirements. Assure *your* operation highest efficiency and economy with Teletax . . . for transmission of *any* standard Foxboro Measurement over *any* transmission system. Write for Bulletin 17-11A. **The Foxboro Company, 348 Norfolk Street, Foxboro, Mass., U.S.A.**

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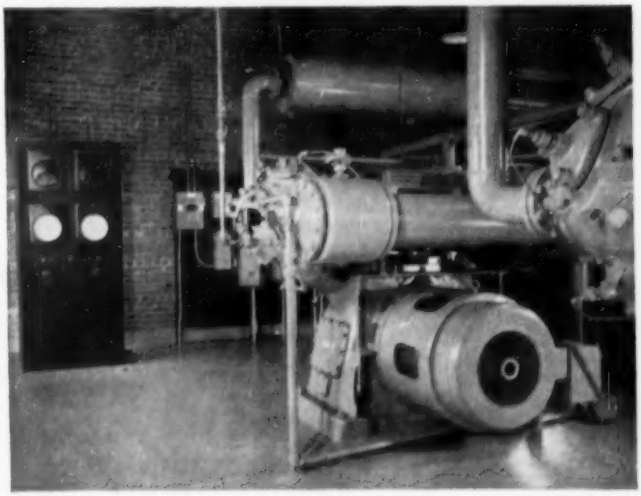
FOXBORO
Reg. U.S. Pat. Off.
TELETAX TELEMETERING

Using Teletax Telemetering, the supervisor at Springfield Gas Light Co.'s main plant (above) controls desired, air/gas ratio at compressor station (below) three miles distant. The company purchases gas from the Tennessee Gas Transmission Company line, stabilizes it to maintain a constant B.T.U. value.



*Reg. U. S. Pat. Off.

the information on the transmitting storage medium such as paper or magnetic tape in block form whereby a physical space is left between blocks of information and is transmitted by a block of information and automatically stopping at the transmitting end and waiting for the receiving end to send a return signal indicating to advance to the next block or in the case of an error to back up and repeat the block. This scheme although somewhat slower than the alternative method is a "fail safe" scheme because in the event of line open or other failure condition it will be known within the interval of a block of information.

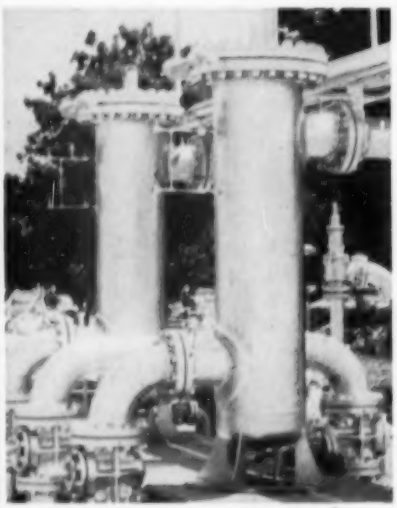
The other general approach is to send information until an error is detected and at this time send a return signal indicating that the transmitting end should stop. Some form of indexing is required in this case also since it is impossible to stop instantly due to transmission time and the mechanical stopping time of the data transmitter. Therefore, the storage medium must be backed up to some index point in order to retransmit information that was in error unless the entire message is retransmitted, which is very wasteful of time. As previously pointed out, this is not a "fail safe" scheme since no return signal would be received due to an open line or other trouble condition. At the expense of additional redundancy, error correcting codes that have the capability of correcting single errors and detecting double errors can be used. Use of this type of code avoids retransmission except in case of double errors.

It is very desirable from a user's standpoint to have standardization of codes. Ideally, a user would like to be able to transmit information from a business machine made by one manufacturer to business machines made by different manufacturers. As you know there has been no standardization of codes in the computer industry although a six-bit information code plus a parity bit is becoming quite widespread. A standardization committee has been formed under the sponsorship of the Joint Computer Conference with the objective of obtaining a standardized code for use over transmission facilities. This would have the decided advantage of at least having one standardized language and would facilitate translation from it to any other desired code. I do not feel it is necessary, nor do I hold out any hope that a completely standardized coding system will be used by the computer and business machine manufacturers. The requirement of specialized symbols that are peculiar to certain businesses makes it virtually impossible to standardize a code that would have enough combinations to take care of all possible contingencies. It is generally agreed, however, except in rare cases that 64 combinations are sufficient. Agreement, however, is difficult to obtain on any other than the basic 26 letters and ten numerals. With a standardized language for the transmission medium, however, it is possible to translate these known codes to whatever is desired. Work is progressing in this field and I am confident that substantial progress will be made in the near future.

MOORLANE

GAS SCRUBBERS

AN ESSENTIAL ACCESSORY
FOR ALL GAS PIPE LINE SYSTEMS



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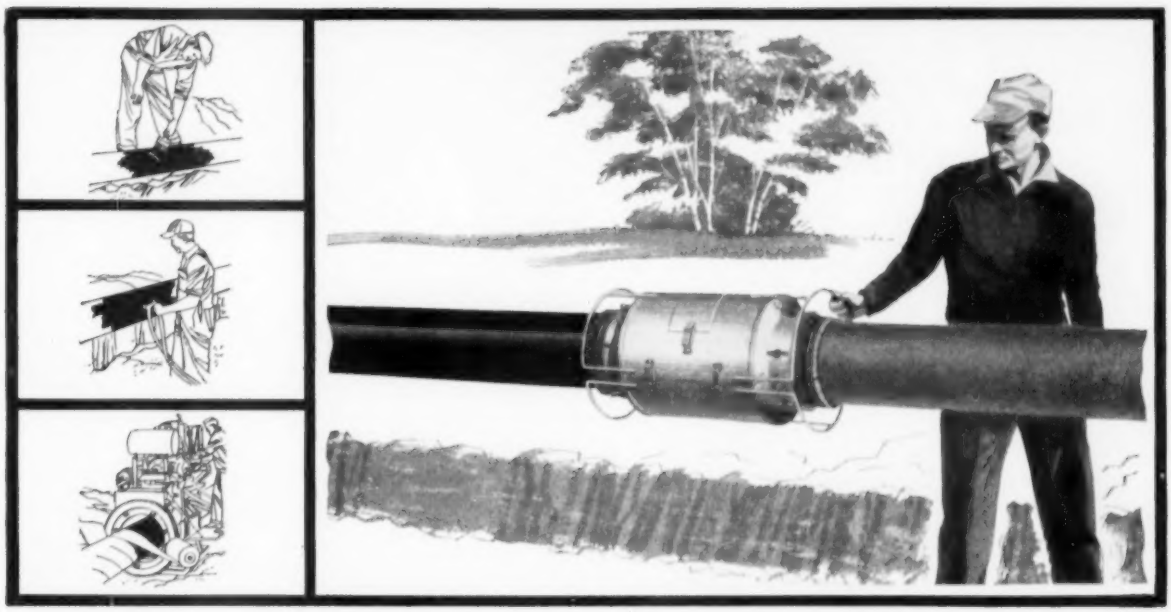

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Because of their ease of application and extremely fast drying time — because they possess the highest electrical resistivity of any cold coating and offer the least amount of objectionable fumes and skin irritants — Roskote pipe mastics have been field approved by more and more leading utilities each year.

In fact, Roskote has been specified by over 200 oil and gas companies for the protection of their natural gas, oil and product pipelines.

A new folder on Roskote, which includes a complete description of its properties, application instructions and full test data, is now available. The test data is of special importance because it gives specific figures on volume resistivity during and after drying.

For a copy of this new folder on Roskote or literature on any other Royston product, just drop a line to Royston Laboratories or any of its district sales offices.

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Model 6QS12
Ledeen **QUAD**
Actuator Mounted
on 24"x26" Plug Valve.

For Operation of High-pressure Plug and Ball Valves up to 36" in Size

A unique four-cylinder design provides direct-acting, balanced torque to the valve stem. The use of cylinders offers the basic construction advantages of simplicity and sturdiness, resulting in long and trouble-free life.

QUAD units provide auxiliary manual hydraulic operation. The gas and oil systems in all Ledeen QUADS are completely separate, eliminating any gas-oil interface.

Features

- **Balanced torque delivered to valve stem through four-cylinder construction.**
- **Gas and oil systems are entirely separate. No gas-oil interface.**
- **For periodic testing, detachable lever permits operation of actuator and controls without turning main valve.**
- **Easy field installation without modification of the plug valve.**
- **Available in wide range of torque capacities, and with a variety of control systems.**

Write for Bulletin 3022

VALVES • CYLINDERS
VALVE ACTUATORS
AIR HYDRAULIC
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Ledeen Mfg. Co.
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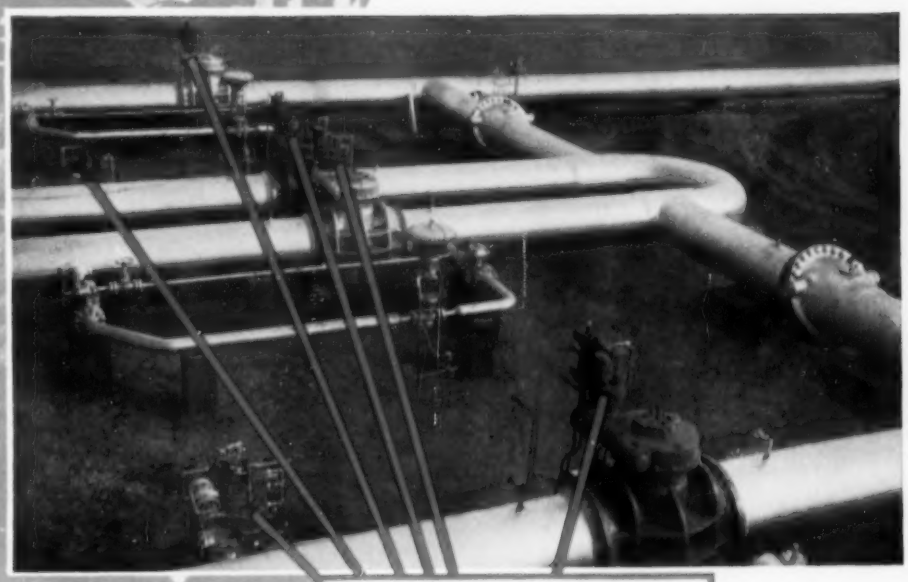
The second topic for discussion is a brief description of a selective calling private line system which is known as the 83B1. Included in the 28 line of teletypewriter equipment which has been developed in recent years by the Teletype Corp. is a selecting device known as a "stunt box." It derived this name by virtue of the many different stunts that it could perform. This stunt box is a very versatile and economical device which makes it an extremely attractive building block for selective calling systems. As it is a part of the 28-type teletypewriter equipment, selective calling features are inherent with this latest type of equipment. Since it is desirable to furnish a selective calling system which will function with the older 19-type teletypewriter equipment, a separate stunt box is furnished. This is shown in *Fig. 1.* As can be seen, this asembly is a standard teletypewriter with all unnecessary parts removed. Advantage is taken of the high production of standard parts in order to make this unit as economical as possible. This accounts for the unused holes and stampings shown in *Fig. 1.* The upper assembly between the brackets is the stunt box and is shown separately in *Fig. 2.* It is a mechanical selecting device which is actuated upon receipt of standard teletypewriter codes. It is a "plug-in" unit which can be readily removed for servicing.

The 83B1 selective calling system consists of a private line having one control station with a transmitter start circuit which is used to control the operation of all the transmitters on the line. Any one of the stations can be the control station with a maximum of 38 stations. In addition to the required control station, the remaining stations can be any one of three classes which are (1) ordinary tape sending stations, (2) tape sending station with an auxiliary typing unit in order to provide hard copy of the prepared tape, and (3) manual keyboard sending where outgoing traffic is so light that tape sending is not required.

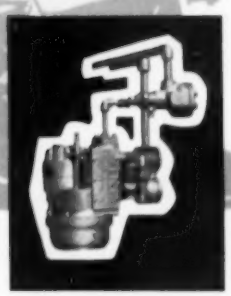
The control station polls the other stations on the line in a prearranged sequence by sending out two-letter transmitter start codes. If a polled station has no tape in

THE E.I.M. FIREMEN



All E.I.M. Installations of This Type Conform With "Emergency Shutdown Facilities" (No. 843.431 Section 8, ASA B31.18-1955)

EVERYWHERE AND ANY TIME THERE'S A FIRE EMERGENCY— YOU'LL FIND THE G-2 CONTROLLING THE SITUATION



EIM G-2 valve controls guide the flow of gas through compressers where the pressure is increased.

With a breach in the line there comes a marked reduction in pressure which, within a matter of seconds, automatically closes the G-2 valve control and re-routes the gas through an undamaged line. In addition to this, a vent valve in the affected area is opened sending a jet of gas from the damaged line spewing harmlessly into the air, thus reducing fire losses to a minimum.

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Crawler BANTAM has high flotation for working in marshy ground conditions where other rigs can't go. Three crawler shoe widths.

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BANTAM is the most versatile pipeliner's rig of its kind—on wheels or crawlers! BANTAM goes anywhere—makes a quick change to work with any of nine job-speeding attachments. There is no need for expensive single-purpose equipment.

BANTAM is sized right to work and travel the right-of-way without bogging down . . . or to handle jobs along busy city streets without interference. BANTAM is the *one* machine that sets you up for digging in soft ground or tough shale . . . rapid backfilling . . . all kinds of dragline and clamshell work . . . handling and placing pipe . . . working out of stockpiles . . . driving pile. A Bantam lifts 10,000 to 14,000 lbs.; digs up to 100 yd. per hour.

You can have the BANTAM as carrier, crawler or self-propelled model. Whichever fits your needs, this is for sure: BANTAM costs you far less to buy . . . to operate . . . and to maintain! Let us prove it.

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☐ I want a BANTAM demonstration

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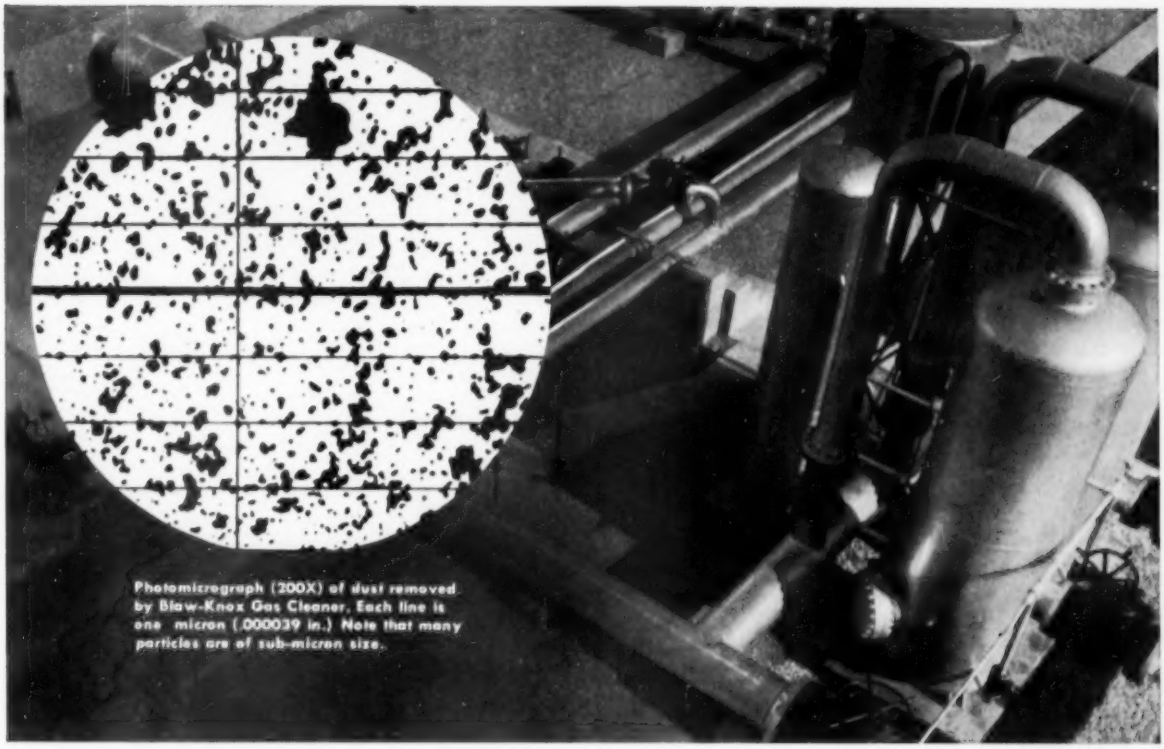
WORLD'S LARGEST PRODUCER OF TRUCK CRANES AND EXCAVATORS

its transmitter, a letter V is sent back which is a no-traffic response signal and the polling of the line continues. In the event of traffic at the station, the transmitter start code from the control station starts the transmitter. The station sends the two-letter call directing character contained in the message and stops. Upon receipt of the letter V from the addressed station, the transmitter again starts and sends the message. Special characters are used to indicate the end of message and when these are received at the control station, polling is resumed in the manner previously discussed. Each station sends one message and the control station then resumes polling in the prearranged sequence. Any station attendant can bid for priority traffic by pushing a priority button and thus obtain preference over regular traffic.

This selective calling system has considerable flexibility and discussion of its many possibilities are beyond the scope of this article due to space limitations. It should be particularly attractive in the field of telemetering and supervisory control where it is desired to combine these functions along with the usual administrative message requirements. For this type of service, spare selecting combinations can be used to connect to devices for telemetering or control purposes. This type of service can also be arranged to provide a printed record of the telemetering and control data. Where only numerical data is required, a two-out-of-five self-checking code can be used to ensure higher accuracy. We are working on an error - detecting scheme which will be suitable for use with the standard five-unit teletypewriter code. This is, of course, applicable to all of the alphanumeric characters and in addition has the advantage of application to existing automatic switching systems where particular characters are used for message directing and switching purposes.

Next month, Mr. Matlack will describe one of the most recently developed supervisory control systems which might be used on a long gas transmission pipeline.


Photomicrograph (200X) of dust removed by Blaw-Knox Gas Cleaner. Each line is one micron (.000039 in.) Note that many particles are of sub-micron size.

dust particles 20 microns and below travel easiest, farthest — do the most damage

Field tests prove Blaw-Knox Gas Cleaners remove even the smallest dust particles

The test of any gas cleaner's efficiency should be measured *not* in terms of the amount of dust collected, but in terms of the quantities entrained in the "clean" gas. The removal of a high percentage of large dust particles is a relatively easy task. However, it is the particle sizes of 20 microns and below that travel easiest, farthest and cause the most damage. Blaw-Knox Gas Cleaners remove even the smallest particles of these dusts.

A large number of field performance tests have been run to determine the dust removal capacity of Blaw-Knox Gas Cleaners. Inlet dust loadings ranged up to 547 pounds per million cubic feet of gas. Tests on the cleaner outlet showed absolutely no dust getting past.

The ability of Blaw-Knox Gas Cleaners to maintain such performance is due to an exclusive operating principle through which each tiny particle of dust is placed immediately in violent, intimate contact with oil. In the expansion separation stages, a major portion of dust-laden oil drops out of the gas stream. An oil-wet, multiple baffle, primary separator catches and agglomerates the remaining tiny wet particles. Finally the gas is scrubbed by an efficient, multiple vane mist extractor.

When you buy, be sure to specify Blaw-Knox, for when you place a Blaw-Knox Gas Cleaner on stream, you're sure to remove even the smallest particles of dust.

Blaw-Knox Electroil and Portable Hot Oil Foggers provide a safe, compact, efficient means of producing a stable oil fog in your gas streams.

A STABLE OIL FOG IN YOUR GAS MAINS:

Will wet down existing dust deposits.

Will prevent drying out and eventual dislodging of existing wet deposits.

Will moisten leather diaphragms.

Will curb internal corrosion of steel mains.

Will prevent loss of odorant by reaction with pipe scale.

Will help to prevent drying out of jute-joint packing.

50th Anniversary BLAW-KNOX 1906-1956

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pipeline people

ROBERT S. JEFFERIES has been promoted to the newly created position of manager of gas storage for New York State Natural Gas Corp., Pittsburgh. He was formerly chief engineer.

S. F. Silloway
Pacific

C. R. Williams
Pacific

STUART F. SILLOWAY has been named president of Pacific Northwest Pipeline Corp., Houston. C. R. WILLIAMS, who has directed the operations of Pacific since 1951, has been appointed vice chairman of the board of directors. Mr. Silloway was formerly vice president for finance of the Mutual Life Insurance Co. of New York.

Philip Fogg
Consolidated

Hugh Colvin
Consolidated

HUGH F. COLVIN has succeeded PHILIP S. FOGG as president of Consolidated Electrodynamics Corp., Pasadena, Calif. Mr. Fogg will continue as chief executive officer and chairman of the board. The company also announces the appointment of RODNEY W. MEYER as export sales manager.

The gathering department of Panhandle Eastern Pipe Line Co., Kansas City, Mo., has organized a new pipeline division and named C. L. FICKLIN as division superintendent.

PAUL E. CHRISTMAN has been named a turbine specialist for General Electric Co.'s Pacific Southwest district, headquartering in Los Angeles.

Several promotions have been announced by Texas Gas Transmission Corp., Owensboro, Ky. They are: D. C. BENSON from superintendent of measurement and research to director of planning and research, W. A. JOHNSON JR. from superintendent of the pipeline department to general superintendent, CHARLES W. BROWN from assistant superintendent of gas measurement to superintendent of that department, and JAMES W. CARNEAL from industrial representative in sales and customer relations to assistant director of sales and customer relations.

D. C. Benson
Texas Gas

W. A. Johnson Jr.
Texas Gas

THE NEW TULSA® POWER TAKE-OFF

SINGLE SPEED • MEDIUM DUTY

Extremely light . . . you can hold it in the palm of your hand . . . because the NEW TULSA Power Take-Off has a die-cast aluminum housing which at the same time gives all the ruggedness and durability for which the TULSA line is famous around the world. Output shaft available in three sizes—13/16", 7/8" and 15/16"—and rotates on two needle bearings. Furnished with either cable or lever control to suit individual operators' requirements. Designed and built for the full range of medium duty work, this new power take-off offers the extra advantage of low price, nationwide distribution and service that have made the TULSA line a favorite everywhere.

Tulsa Winch
TULSA, OKLAHOMA DIVISION OF VICKERS Inc.

W. W. Cabell
Mathey Machine

L. V. Orton
Mathey Machine

WILLIAM W. CABELL has been named vice president and general sales manager for the C. A. Mathey Machine Works Inc., Tulsa. At the same time, L. V. ORTON was promoted to vice president in charge of development and production. Mr. Cabell replaces GEORGE L. TEMPLE, who is now general manager of Reading & Bates Off-Shore Drilling Co.

D. A. HARDESTY has been elected assistant vice president of the Natural Gas Pipeline Co. of America and its affiliate, Texas Illinois Natural Gas Pipeline Co. He heads employee and public relations activities for the companies.

N. KNOWLES DAVIS, former chief engineer of the Georgia Public Service Commission, heads the newly formed rate department of Tennessee Gas Transmission Co., Houston.

R. B. GAINES has joined the gas reserves and availability section of the gas supply department of Northern Natural Gas Co., Omaha, as geological engineer.

C. B. NEWMAN has been named by Southern Natural Gas Co., Birmingham, to the newly created post of Mississippi manager of public relations and industrial development.

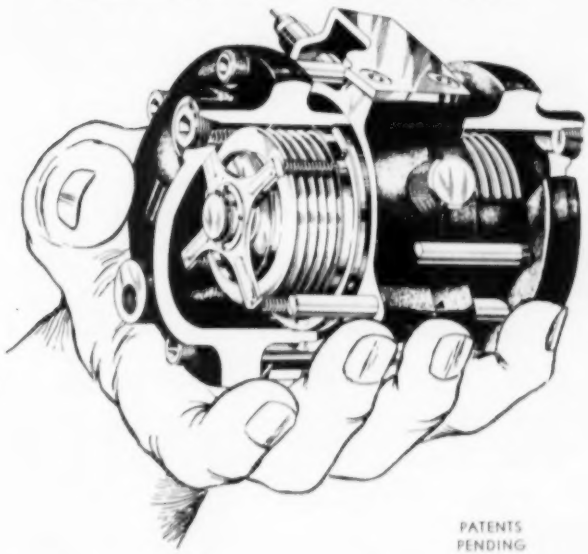
Texas Gas Corp., Houston, has named PHILIP M. CORDELL JR. as coordinator and economist.

C. W. Brown
Texas Gas

J. W. Carneal
Texas Gas

NEW I.I.C. miniature Dp unit

only 4" x 5" with all the features of larger meters standard ranges in inches of water and p.s.i.



PATENTS PENDING

I.I.C.-Moore Transmitter
Model 300-MT

MODEL 300

This new miniature D/P Unit is a scaled-down version of I. I. C.'s full size flow meter, incorporating all the I. I. C. features and advancements which have met with international success in bellows type flow meters.

- **Compact, light weight, easy to install**
- **Seamless bellows, type 316 Stainless or Monel**
- **Pulsation dampener adjustable externally under pressure**
- **Compensation for ambient temperatures**
- **Overrange protection to housing rating**
- **Furnished in all standard differential ranges in inches of water and p.s.i.**
- **Forged steel housings, alloy or 316 stainless steel. Working pressures 1000, 2500 and 5000 p.s.i.**

It's the only meter of its size with all big-meter features.

For full information—including the name of your nearest representative, write for Bulletin 56-B-2.

6" Dial
Model 400-6
Also available with
3" dial (Model 400-3)

INDUSTRIAL INSTRUMENT CORP.

DRAWER 152 ODESSA, TEXAS

GAS pipeline news

API issues 4th edition of pipe welding standard

The fourth edition of its "Standard for Field Welding of Pipelines," reflecting recent developments in pipeline welding, has been published by the American Petroleum Institute.

The standard has been elevated and is no longer considered "tentative." In addition to several minor changes, the fourth edition includes a section that allows multiple qualification of welders under certain circumstances. A committee composed of representatives from the American Gas Association, Pipeline Contractors Association, Pipe Manufacturers, American Welding Society, Society for Non-Destructive Testing, and the API prepared the standard and its latest revisions.

Copies of the "API Standard 1104 (4th edition), Standard for Field Welding of Pipelines" may be obtained from J. A. McNally, API, 50 W. 50th St., New York 20, for 50 cents each.

Major expansion proposed by El Paso Natural

El Paso (Texas) Natural Gas Co. plans to spend $84.5 million on new facilities in Texas and New Mexico that will increase system capacity by 150 MMcf/day (Docket G-10499).

Leading the program will be the construction of 900 miles of new transmission and gathering lines, including 288 miles of gathering lines in the Panoma area and 252 miles of San Juan gathering system lines.

Transmission construction comprises 83 miles of 34-in. loop along the San Juan mainline and 20 miles of 30-in. paralleling the existing Permian-San Juan line.

New compressor station construction includes 5000-hp units at Laguna and Roswell and 2000- to 4800-hp additions at five existing plants. A 12,000-hp station will be built at Chaco and a 7700-hp addition is contemplated for the Lindrith field compressor station. Three dehydration plants and metering and communication facilities are also planned.

Lone Star increases underground storage

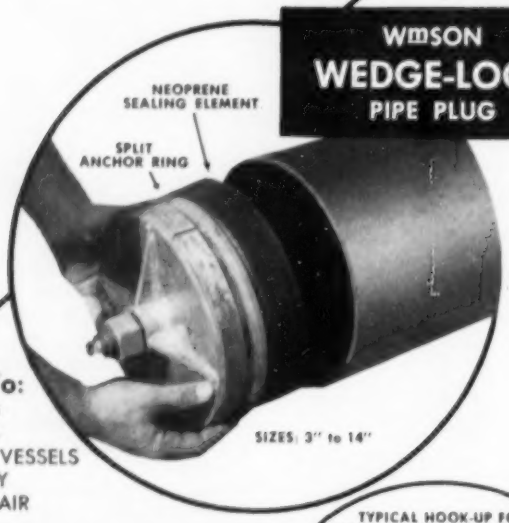
What is reportedly the world's deepest and highest pressure underground natural gas storage reservoir will be placed in operation by Lone Star Gas Co. late this summer or early in the fall. The new project brings to Lone Star its fourth underground storage unit.

According to Julian Foster, vice president in charge of the company's transmission division, Lone Star will store up to 35 billion cu ft of gas in two of the four pay horizons in the Tri-Cities multi-pay field in Henderson county, near Athens, Texas.

Lone Star reservoir engineers calculate that approximately 20 billion to 25 billion cu ft of gas can be stored in the Bacon limestone

Here's a better way...

TO PLUG PIPE ENDS TEMPORARILY



In Order To:
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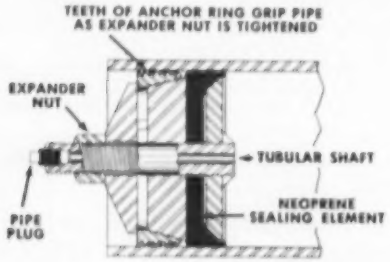
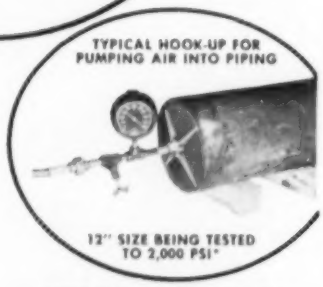
- ADD FITTINGS
- TEST PIPING & VESSELS
- PROPEL PIGS BY COMPRESSED AIR


TEETH OF ANCHOR RING GRIP PIPE AS EXPANDER NUT IS TIGHTENED
EXPANDER NUT
TUBULAR SHAFT
NEOPRENE SEALING ELEMENT
PIPE PLUG



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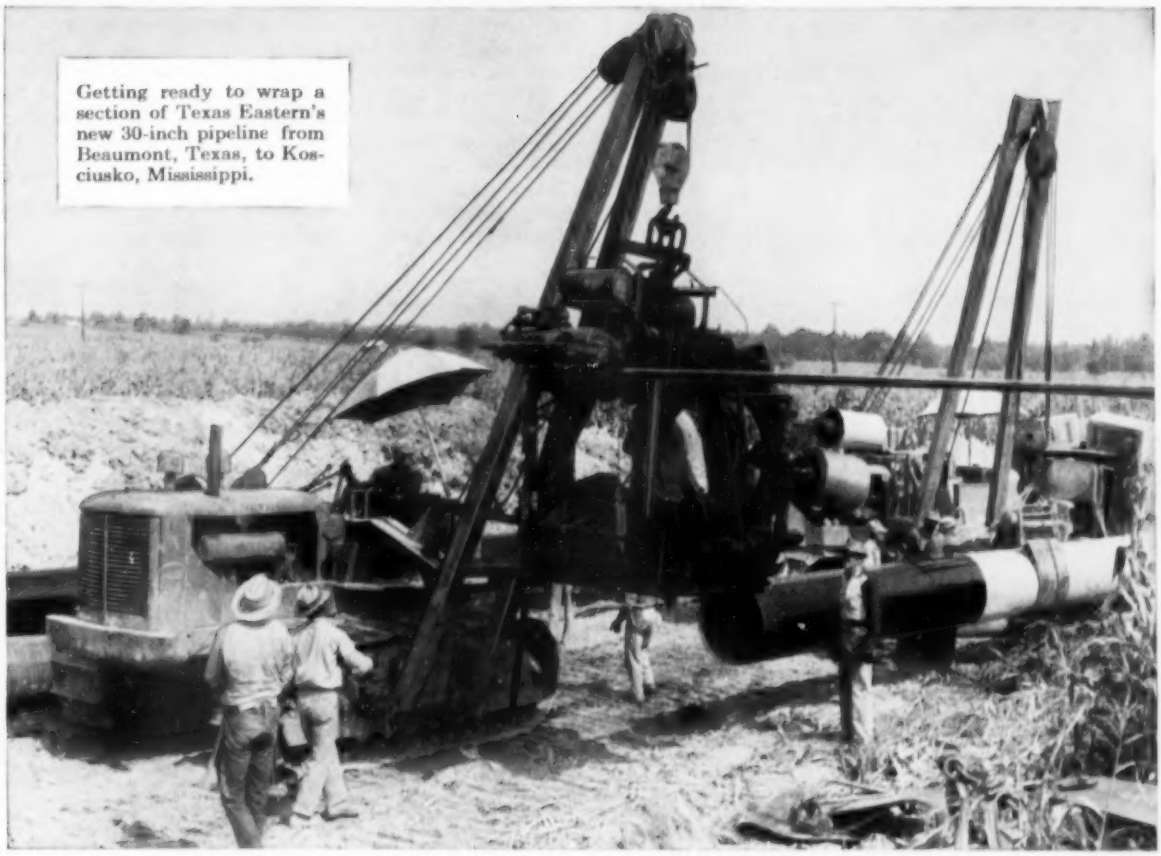
PIPELINE news from L·O·F GLASS FIBERS COMPANY



Getting ready to wrap a section of Texas Eastern's new 30-inch pipeline from Beaumont, Texas, to Kosciusko, Mississippi.

Texas Eastern used Blue Flag to help protect its new 30-inch pipeline

Companies with large pipeline investments know they can rely on L·O·F Glass Fibers' Blue Flag Reinforcing Pipe Wrap. A Blue-Flag-reinforced coating prolongs pipeline life years longer than unreinforced coatings . . . yet costs less than .5% of the original investment!

Here are other reasons why Blue Flag increases application efficiency, helps protect pipelines from corrosion . . .

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- Helps protect coating from backfill damage!
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and approximately half that amount in the Rodessa. Cushion gas will total about 10 billion cu ft and native gas approximately 3 billion, leaving 17 to 22 billion cu ft of working gas.

Both the Bacon and Rodessa pay horizons, discovered in 1941, are now virtually depleted. Bacon pressure is down to about 150 psi while pressure ranges from about 195 psi to 600 psi in the Rodessa. By building reservoir pressure to the original level, Lone Star also expects to recover added volumes of condensate from the Bacon and crude oil from the Rodessa.

With injection of storage gas expected to begin soon, Lone Star's timetable calls for reservoir pressures to be built back up to original levels in 1958. Substantial liquid recoveries, however, should be realized by late 1957. Both zones will be cycled during off-storage and off-withdrawal periods.

A site for the compressor and dehydration plants has been cleared and engine blocks have been poured for the plant's three 1350-hp compressor units. The plant will inject up to 80 MMcf of gas from the fields in the east-central Texas area.

Remedial work on injection and withdrawal wells will start immediately. There are now 38 wells producing from the two pays. Six of these wells will become inputs, some of the remaining wells will be plugged and the rest used for withdrawal.

Dresser joins in packaged off-shore drilling venture

What is believed to be the first "packaged" production of specialized ships for the offshore oil industry is planned through a joint venture of Dresser Industries Inc. and the New York Shipbuilding Corp., which operates as the shipbuilding department of Merritt-Chapman & Scott Corp.

The initial $3.5 million contract calls for construction of two vessels fully equipped for drilling operations in the Gulf of Mexico. One ship is a 2500-gross-ton drilling tender, the other a 297-ton cargo-supply ship, both to be built for the Coastal-Marine Drilling & Construction Corp., Houston.

The ships, both self-propelled and entirely self-contained, will operate as a highly mobile team—complete with helicopter port atop the tender's bridge deck. They are the first of many that Dresser and New York Ship expect to build to meet the acute needs of the petroleum industry for adequate equipment to develop the potentially great resources off the Gulf Coast.

FPC reverses examiner in data protest by TET

Interveners representing coal, railroad, barge and oil transport interests have been subpoenaed by an FPC presiding examiner to produce certain data in the proceedings involving proposals by Texas Eastern Transmission Corp. to expand its system.

In issuing an order to the examiner to subpoena the interveners, the FPC reversed the examiner's earlier ruling which had denied the Shreveport company's request. Texas Eastern claimed that the data were necessary to determine whether competition existed between it and the interveners and whether the interveners could be aggrieved or adversely affected by an order which would grant the requested certificate.

Texas Eastern's applications includes its proposal to retire its

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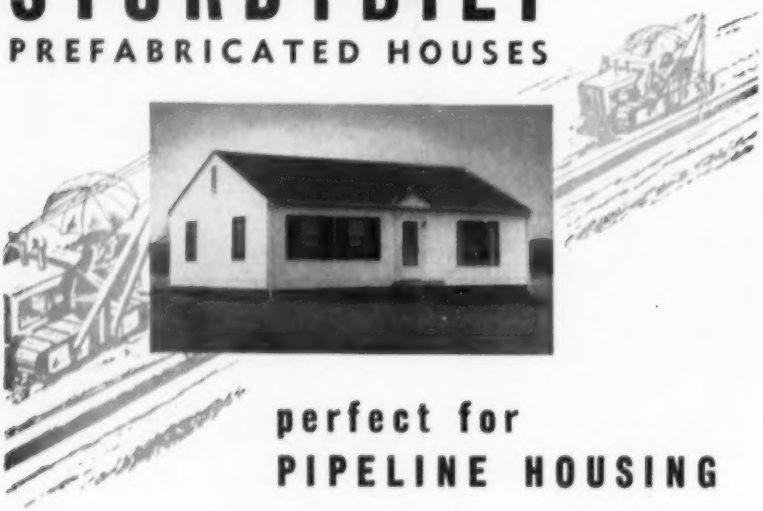

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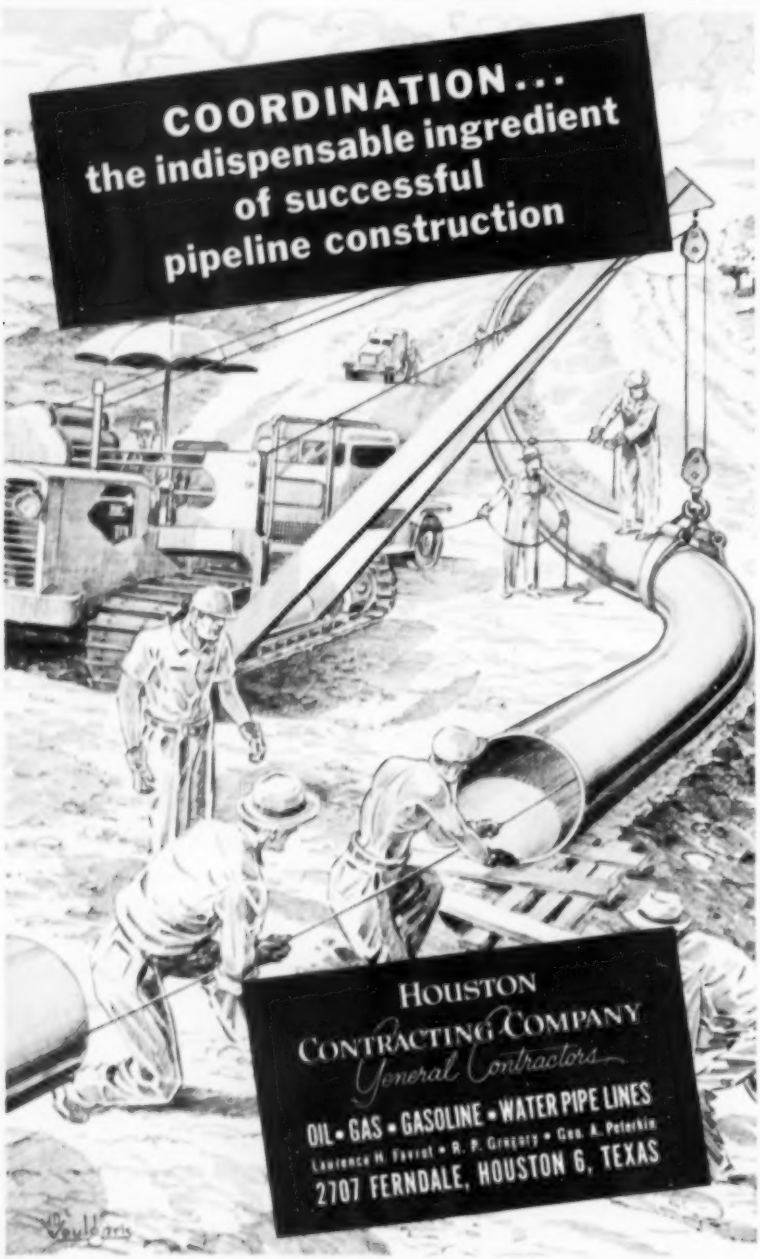
Little Inch pipeline and to construct additional facilities.

In reversing the examiner, the FPC cited an earlier court case in which it had sought to have an appeal of the National Coal Association dismissed because the record contained no evidence that it was in fact adversely affected or aggrieved. The FPC said the court's ruling showed that the necessity "for placing appropriate facts and evidence from which an interest and extent thereof as well as aggrievement may be determined by the commission is not upon the interveners."

The commission declared that denial of the requested subpoenas would, if the interveners failed to produce evidence in these particulars, "foreclose a factual presentation of record with respect to the true interest and possible aggrievement of interveners." "Such result should not be permitted," the FPC asserted. "An intervener asserting an interest and potential aggrievement should not have it within his power thus to prevent development of a proper record. One alleging an interest and that such interest would be adversely affected should have no hesitancy in undertaking voluntarily to present all facts with respect thereto."



Pennsylvania storage facilities increasing

Plans of Texas Eastern Transmission Corp., Shreveport, and New York State Natural Gas Corp., Pittsburgh, to construct and operate facilities in their jointly owned Oakford storage field have been approved (Docket G-10130).

At a cost of $1.9 million, the companies will install a 6000-hp compressor at the existing Jeanette station and transfer a 350-hp unit from Jeanette to the South Oakford station. They will also build 4 miles of miscellaneous line and 24 measuring stations at the storage field in Westmoreland county, Pa.

With the additional facilities, the companies will be able to withdraw full season deliveries at a minimum of 400 MMcf daily and permit peakday withdrawls of 700 MMcf.

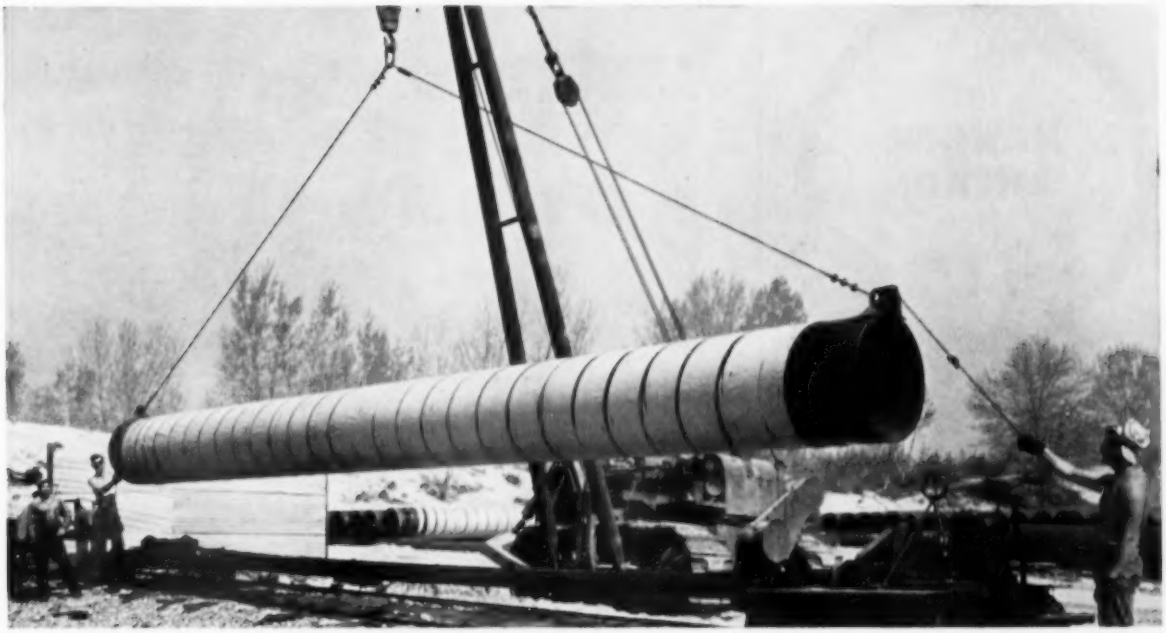
TGT links five states with 700-mile microwave

Construction of a 700-mile RCA multi-circuit microwave radio relay system, which will span a five-state area to link all compressor stations and key operational offices of Texas Gas Transmission Corp., will be started this summer.

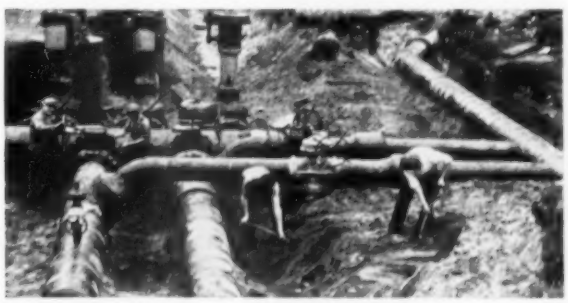
According to W. T. Stevenson, Texas Gas president, and C. M. Lewis, manager of the communications products department of Radio Corp. of America, the microwave system is part of a current $20 million TGT construction program.

The installation, a "turnkey" job to cost more than $750,000, includes all necessary microwave station buildings and towers from Texas Gas headquarters in Owensboro, Ky., to the corporation's Louisiana division offices in Lake Charles, La. It will link the company's 23 compressor stations and numerous field offices and installations in Kentucky, Tennessee, Mississippi, Arkansas, and Louisiana. The contract also calls for operational personnel to be trained by RCA.

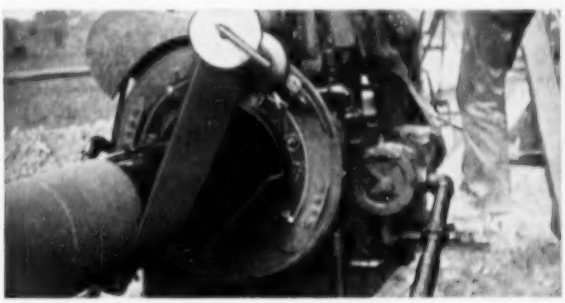
Saying that the need for the multi-circuit system has been apparent for some time, Mr. Stevenson pointed out that the RCA system is designed to provide more adequate and reliable communications for operational control of the 3442-mile TGT system.



KING SIZE PROTECTION: 36" pipe, mill coated first with NO-OX-ID 6X for bonded insulation against moisture, then shielded with No. 7 NO-OX-IDized Wrapper and Service Coat for added electrical resistance and protection against soil stress. Finally, a kraft wrap to protect from damage in handling operations. This is long-term pipeline protection at its best.



WHERE ELBOW ROOM IS SCARCE: In crowded work space, No. 4 NO-OX-IDized Reinforced Fabric Wrapper is hand applied around irregular fittings such as valve manifolds on gas lines. No. 4 Wrapper, a coated fabric laminated to a plastic membrane, provides moisture-proof seal over pipe coating.



PROTECTION BY THE MILE: A NO-OX-ID coating combination is uniformly applied over-the-ditch by this traveling type machine. The NO-OX-ID 6X Base Coating is covered with an unbroken shield of No. 7 NO-OX-IDized Wrapper. The fabric side of the wrapper is an excellent surface for bonding a service coat.

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Wherever pipelines go—into long or short line service, through rough terrain or rolling plains—there is a NO-OX-ID coating combination plus a method of application for long-term protection against corrosion.

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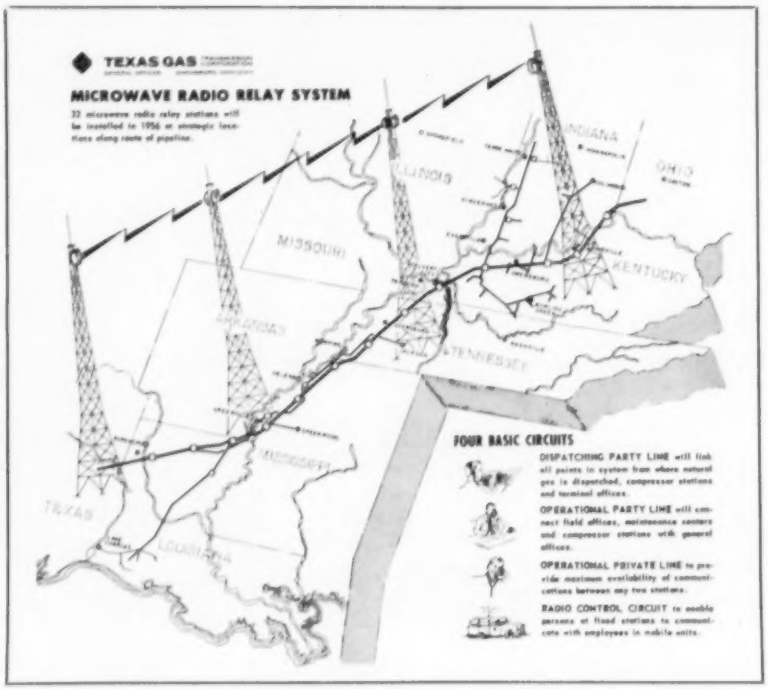
TEXAS GAS
MICROWAVE RADIO RELAY SYSTEM
32 microwave radio relay stations will be installed in 1956 at strategic locations along route of pipeline.
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KENTUCKY
TENNESSEE
ARKANSAS
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FOUR BASIC CIRCUITS
DISPATCHING PARTY LINE will link all points in system from where natural gas is dispatched, compressor stations and terminal offices.
OPERATIONAL PARTY LINE will connect field offices, maintenance centers and compressor stations with general offices.
OPERATIONAL PRIVATE LINE to provide maximum availability of communications between any two stations.
RADIO CONTROL CIRCUIT to enable persons at fixed stations to communicate with employees in mobile units.

The 700-mile multi-circuit microwave radio relay system which will span a five-state area linking all compressor stations and key operational offices of TGT.

"A monitored survey of our present leased, full-period telephone circuit showed an average delay of 88 minutes in completion of operational calls from Owensboro to points south of Memphis because the circuit must be used most of the time by our dispatching department," he said. "The Owensboro-to-Lake Charles microwave relay system will eliminate this delay and make possible almost instantaneous connection between any two company locations that are in the microwave network."

Approximately 32 stations will be established over the 700-mile span and standard RCA CW-20-A microwave equipment will be used, Mr. Lewis of RCA said. Initially, the system will have 32 channels, he said, and it can be expanded for operation of as many as 60 channels as well as to provide additional services, such as telemetering, facsimile, and supervisory control.

Four basic types of circuit lines included in the 32 channels are: (1) A dispatching party line linking all points in the TGT system from where natural gas is dispatched, compressor stations and four terminal offices; (2) an operational party line for general operational traffic, connecting field offices, maintenance centers and compressors stations; (3) an operational private line for maximum availability of communications between any two stations in the system; and (4) VHF radio control circuit which will enable persons at fixed locations to talk with employees in any of the 118 VHF mobile radio units operated by the company.

An additional feature of the microwave installation will be an alarm system for automatically notifying maintenance personnel of failure of tower lights or flashing beacons, power difficulty or switchover of a station to standby operations.

Litigation continues on Tioga-to-Minot line

More litigation has sprung up between Montana-Dakota Utilities Co. and the North Dakota PSC. Rates to be charged are the focal point of the latest flurry in the battle the utility company has been waging to get a permit to build the pipeline it has already built and has been operating for four months.

Montana-Dakota built the 80-mile, 12-in. line from Tioga to Minot without a PSC permit under the contention that it was merely extending its system from Williston and a utility does not need a permit to construct extensions of

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UNION Centralized Transport Control has been in successful operation on a number of pipelines and has proved highly dependable. It can give you reliable remote control and indications, and monitor the data for your entire pipeline from one central dispatching office. Among the many installations, two stand out for their unusual applications of UNION Centralized Control.

TYPEWRITER AND CONSOLE used in a UNION C.T.C. System.

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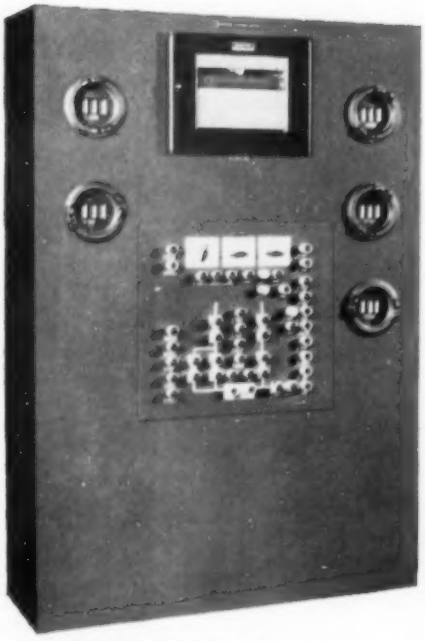

UNION CONTROL PANEL for a gas-compressor station.

1. Complete remote control of pipeline pumping station with digital telemetering of variables. The information to be telemetered is incorporated into the Union Switch and Signal C.T.C. Code System in digital form. Transmission is protected the same as all controls and indications with assurance against errors in transmission. Information is automatically logged on a typewriter at periodic intervals, initiated on demand or initiated by upset conditions on the line. Entire systems can operate within 0 to 15 cycles minimum pulse rate to meet low-cost lease lines requisites.

2. Remote control of start-up, monitoring the operations and shutdown of a 3700 HP internal combustion engine driving a compressor on a natural gas pipeline. Engine speed is varied to control discharge pressure. Discharge controller set point controlled to a fineness of one part in 999 from remote location. Data telemetered digitally to main office by teletype.

UNION Centralized Transport Control can be used anywhere on pipeline layouts, gas distribution systems, gathering systems, tank farms and offshore installations. It has been thoroughly proved in service and is backed up by experience in centralized control covering more than 25,000 miles of long haul transportation. Write for booklet 1052 for information on your single or multiple station control requirements.

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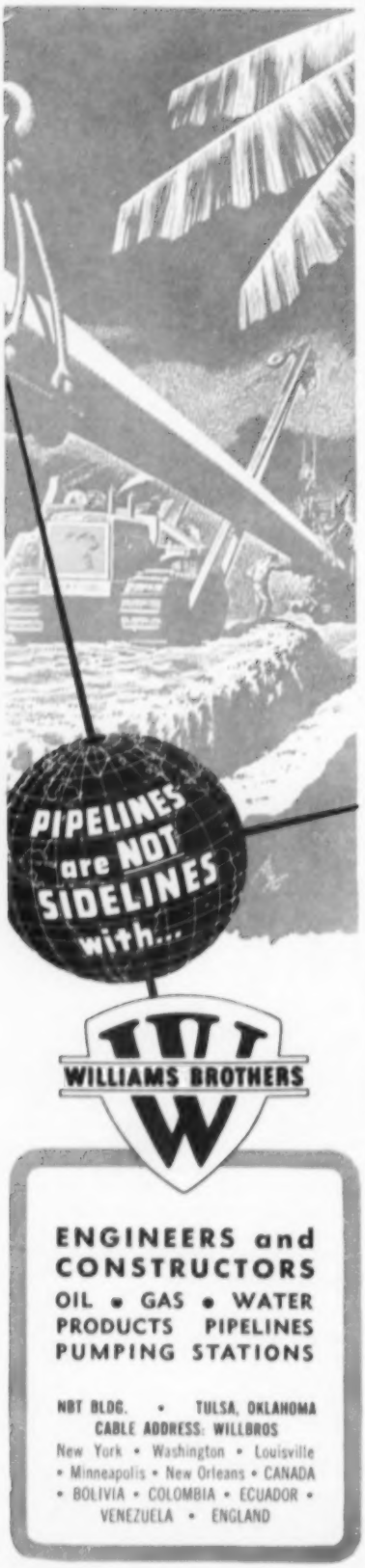

existing systems into nearby territory. It placed the line in operation during January of 1956 under a district order. An FPC examiner has recommended the granting of a certificate to Montana-Dakota for the line.

Now, the utility company's original application has been reopened by the PSC with the purpose in mind of lowering the price at which Amerada Petroleum Corp. and Signal Oil & Gas Co. sell gas to Montana-Dakota Utilities Co. at Tioga.

PSC says Montana-Dakota pays 16 cents/Mcf for the gas and claims that the tax value of it is only 4.5 cents/Mcf. The state commission wants to get the testimony of both Signal and Amerada into the record. The FPC examiner has upheld the prices as reasonable as Amerada sells "dump" gas at 9 cents/Mcf and Signal sells residue gas from its big Tioga plant that processes gas for Amerada and other producers in the area.

GAMA issues 1956 construction round-up

The Gas Appliance Manufacturers Association has issued its 1956 edition of "Natural Gas Construction Data," which presents detailed information on 97 per cent of the total pipeline projects authorized by the Federal Power Commission in 1955.

Expansion authorized during the year involves more than 5700 miles of line and expenditures exceeding $660 million. Also included are projects pending FPC action, a summary of post-war expansion, pipeline plans indicated during January-May 1956, growth of the pipeline network, names and addresses of transmission companies, cities benefiting by 1955 authorizations, and natural gas reserves and production.

More information on the summary is available from GAMA, 60 E. 42nd St., New York 17.

API sponsors pipeline school

A "School of Pipeline Technology" will be launched by the division of transportation of the American Petroleum Institute to help insure the availability of qualified manpower.

The school will be operated by the Petroleum Extension Service of the University of Texas, in cooperation with Lee College, Baytown, Texas, and the Trade and Industrial Service of the Texas Education Agency.

Present plans call for the school to open its fall term around Oct. 1 and its spring term in February. Each six-week term will be complete in itself.

Topics to be covered include the economics and history of pipeline transportation, personnel organization, industrial and public relations, mainline design and construction, mainline maintenance, mainline corrosion control, gathering systems design and construction, gathering systems operation and maintenance, mainline tank farms, terminals, mainline stations design and construction, mainline stations operation and maintenance, scheduling and dispatching, communications, and reclaiming and salvage.

GAS Pipeline notes

Recently approved plans of Gulf Interstate Gas Co., Houston, enable the company to increase its designed capacity from 375 MMcf of gas/d to 401 MMcf/d. Estimated to cost $2 million, the expansion consists of additions of 2000-hp compressor units at stations located in Kentucky, Mississippi, Tennessee, and Louisiana.

Northwest Production Corp., a subsidiary of Pacific Northwest Pipeline Corp., has started a full-scale oil and gas development program on San Juan basin leases acquired from Pacific Northwest. Ray Fish, chairman of the board of both companies, says drilling has begun on three wells, and that 50 to 100 wells will be drilled this year.

Newest member of the Federal Power Commission is Judge Arthur Kline, Republican from Wyoming, who has been named to succeed Commissioner Claude Draper. The Senate approved his appointment by unanimous consent and without debate.

A new pipeline contracting firm, Sharman, Allen, Gay & Taylor Inc., has been organized. Heading the company is J. W. Sharman as president. He was formerly with Latex Construction Co., Houston Contracting Co., and Associated Pipe Line Contractors Inc. Other officers are John M. Gay and S. A. Taylor. Headquarters are in Houston.

Northern gets okay to test Iowa storage

Northern Natural Gas Co., Omaha, has temporary authority from the FPC to construct pipeline facilities in Texas, Kansas, Nebraska, and Iowa which will increase its system sales capacity and enable it to test its Redfield, Iowa storage project.

About 15½ miles of loop will be built, and 12,640 hp capacity added to Northern's system.

The temporary authorization also allows the company to construct and operate 28.4 miles of line and modify compressor units at the Redfield storage project on an experimental basis.

The estimated cost of the facilities is $6.3 million, which includes $4.7 million for the mainline facilities and $1.5 million for the storage project. The facilities covered by the authorization are part of an overall project proposed by Northern, estimated to cost $32 million and which are designed to increase the system's sales capacity by about 90 MMcf/day.

Montana-Dakota plans new Montana facilities

Montana - Dakota Utilities Co., Minneapolis, will spend $1,054,120 to build natural gas pipeline facilities in Montana (Docket G-10521).

Proposed construction consists of 28.3 miles of 12¾-in. mainline pipe from Fallon county to Dawson county; installation of a 660-hp compressor unit at its Cabin Creek station, together with new water-cooling facilities for the entire plant; and two 540-hp compressors at its Baker station.

The company says that with the additional facilities it will be able to take residue gas that is now being flared in the Tioga field in North Dakota.

Hope Natural drills for new gas supplies

A $9.5 million expansion program, including expenditures for production, transmission and storage facilities, is announced by Hope Natural Gas Co., Clarksburg, W. Va.

Hope President E. H. Tollesson said the largest single expenditure would be more than $2 million for a compressor station at Churchville, Lewis county.

Line expansion includes 32 miles of 12¾-in. pipe in Wyoming and Logan counties, 5 miles of 6⅝-in. pipe in the Buckhannon area, and several miles of smaller pipe in Wyoming and Logan counties.

Mr. Tollesson said the company is engaged in an extensive drilling and exploration program. Included are 50 wells for new gas supplies.

PG&E launches looping of Super Inch line

Work is getting under way on Pacific Gas & Electric Co.'s $10 million addition to its Super Inch line which will increase the company's out-of-state supply.

Norman R. Sutherland, president of the San Francisco company, said the general pipeline contract has been awarded to the joint venture firm of Midwestern-Johnson-Dixon. It calls for the installation of three sections of 34-in. pipe for a total of 85 miles. These will parallel portions of the 502-mile mainline which extends from the California-Arizona border near Topock to the Milpitas metering station at the southern end of San Francisco Bay.

The normal capacity of the line will be increased from 700 MMcf daily to 750 MMcf.

Under other contracts which are part of the project, 6620 hp of additional compressor capacity will be installed, raising the total on the Super Inch to 74,480 hp. Eight 1760-hp compressors will be increased to 2050 hp each. At Topock, an existing 2500-hp compressor will be converted to 3300 hp and a new 3500-hp unit will be installed.

A second pipeline bridge is scheduled to cross the Colorado river at Topock.

Other construction includes a 38.5-mile extension northward from the Santa Clara county hills near Gilroy to Milpitas, a 25-mile section from west of Kerman to Llanada, and a 21.5-mile section west from Topock.

When the 85 miles of parallel pipe are installed, only 138 miles of the big line will be of single loop. Mr. Sutherland says that PG&E is preparing to loop 65 miles of the single-pipe miles to increase daily deliveries further to 875 MMcf next year.

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YOU NEED THESE
New REED HINGED 4-WHEEL PIPE CUTTERS
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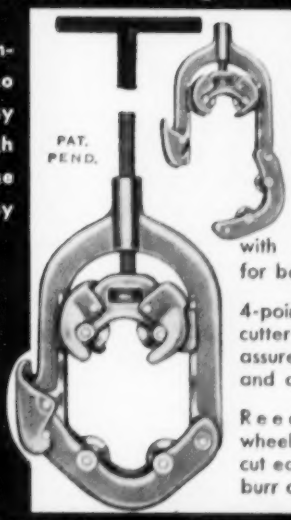

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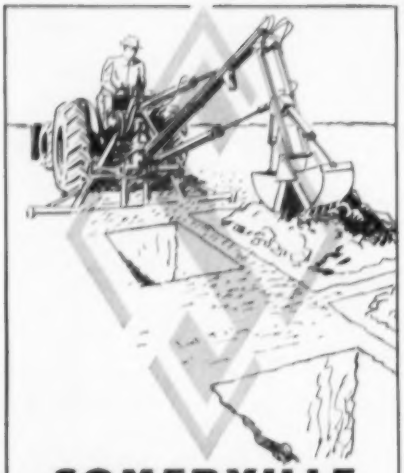

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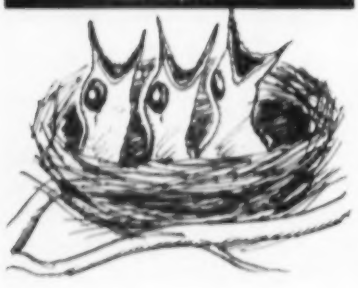


GAS progress reports

NEW CONSTRUCTION PLANNED

MONTANA-DAKOTA UTILITIES CO., Minneapolis. Docket G-10521 for 28.3-mile 12-¾-in. mainline pipe from Fallon county to Dawson county, Mont.; install 660-hp compressor unit at Cabin Creek, Mont. station; and two 540-hp compressors at Baker, Mont. station.

WASHINGTON (D.C.) GAS LIGHT CO. Docket G-10090 for 26.1-mile, 24-in. line from Dranesville, Va. to a point near Washington.

CURRENT CONSTRUCTION

AMERICAN LOUISIANA PIPE LINE CO., Detroit. Docket G-2306 to construct 1260 miles of line—30-in. from North Tepetate, Acadia parish, La., to connect with Michigan Consolidated facilities near Detroit; 24-in. to feed into 30-in. line in Louisiana, also three 10,000-hp compressor stations. Brown & Root has laid 150 miles, Houston Contracting 205 miles, H. C. Price 223 miles. All major river crossings are complete. Compressor stations 72 per cent complete. Completion is scheduled for August or early September and project is on schedule.

ARKANSAS LOUISIANA GAS CO., Shreveport. Docket G-2307 for 134 miles of 6⅝- to 24-in. line in 11 sections, and 10,500-hp compressor station on its system in Arkansas, Louisiana, and Texas. Compressor station and 71 miles of line completed.

COLORADO INTERSTATE GAS CO., Colorado Springs. Docket G-2121-(1956 program) 239 miles of 22-in. line from Laramie, Wyo. to connection with Pacific Northwest Pipeline Corp. line at Green River, Wyo. R. H. Fulton will start two spreads April 15. Completion by Nov. 1.

MISSOURI PUBLIC SERVICE CO., Warrensburg. Docket G-2057 for 109.3 miles of 8- and 10-in. mainline and 27.1 miles of lateral lines. System to connect with Panhandle Eastern Pipeline Co. line at New Franklin, Mo. and extend northwest. O. R. Burden Construction Co. started work on line in May. Expect completion in September.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh. Docket G-9860 for 27-mile extension of existing line to extend line from Elk county, Pa. to new Luthersburg gas field in Clearfield, Jefferson, and Indiana counties, Pa. Harford Brothers started construction April 2. Proposed completion: July 1.

PACIFIC GAS & ELECTRIC CO., San Francisco. Midwestern-Johnson-Dixon at work on 149.6-mile, 34-in. line paralleling Super Inch from Topock, Ariz. to Milpitas, Calif. Included in program are compressor additions totaling 9260 hp at Topock, Hinkley, and Kettleman stations.

PACIFIC NORTHWEST PIPELINE CORP., Houston. Dockets G-1429 and 8932 et al for 1487 miles mainline; 443 miles of spur and lateral lines; and 13 mainline compressor stations totaling 83,500 hp and 2 booster stations totaling 4620 hp, to extend from Ignacio, Colo., in the San Juan basin to Sumas, Wash. (Canadian border). Fish Northwest Constructors Inc., builders of the line, have let contracts to River Construction Corp., R. H. Fulton & Co., Associated Pipeline Contractors, A. J. Curtis Construction Co., B. & M. Construction Co., Midwestern Constructors Inc., H. B. Zachry Co., and Fulghum Construction Co. for first 1061 miles. Completion scheduled for fall of '56. Total construction by April: 1017 miles of mainline lowered and 276 miles of laterals and gathering systems.

PERMIAN BASIN PIPELINE CO., Omaha. Dockets G-9688 and 9724. For 19-mile, 16-in. line and 6750-hp compressor station in Andrews county, Texas, to take gas from Phillips gasoline plant. Gasoline Plant Construction Corp., Houston building compressor station; R. H. Fulton the line.

TEXAS GAS TRANSMISSION CORP., Owensboro, Ky. Docket G-8828 for 189 miles of line and 19,190 hp in compressor capacity along its system in Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, and Indiana. Contracts for 10,820 compressor hp let to Longview Equipment Co. and 7500 hp to Ford, Bacon & Davis. Compressor construction begun. Work completed on 9.2 miles of pipe, contracts let on remainder to Houston Contracting Co., Williams Brothers Co., and Union Construction Co.

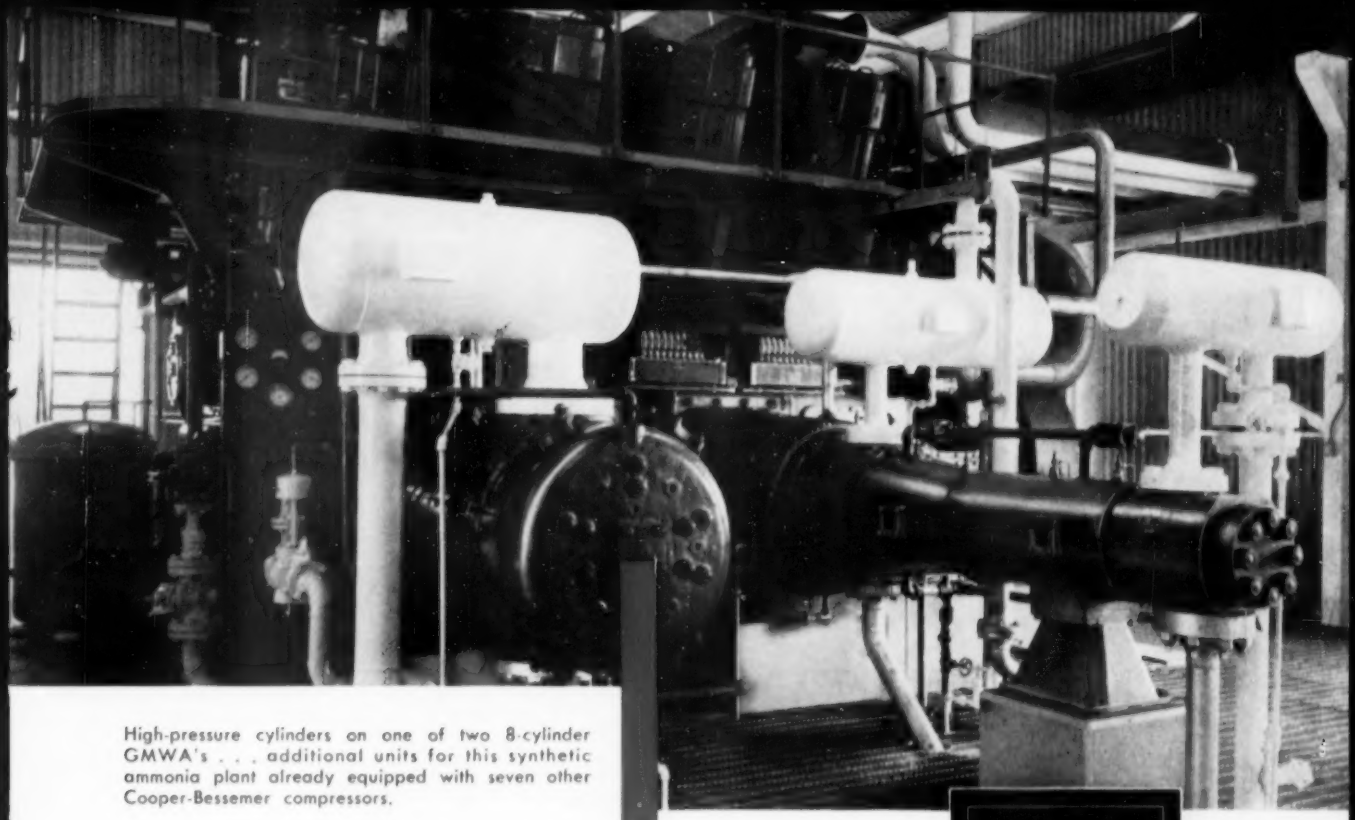
TENNESSEE GAS TRANSMISSION CO. Houston. Docket G-2534, et al, to build approximately 220 miles of 26- and 30-in. mainline loops paralleling its system in Kentucky and Ohio; installation of 12,540 hp additions; and 376 miles of line required to connect its new gas supplies, 355 of which will comprise an extension of its system into southeastern Louisiana. About 75 per cent of pipe lowered in on Louisiana portion as of June 5. Completion scheduled for early summer.

WESTCOAST TRANSMISSION CO. LTD., Calgary. To build 650-mile, 30-in. line from Peace river area to near Vancouver, B.C., to connect with line of Pacific Northwest Pipeline Corp., to transport 370 MMcf daily, of which 300 MMcf is to be delivered to PNW. Work has commenced on all four sections between Peace river and International Border. Scheduled for completion in 1957.

APPROVED

GULF INTERSTATE GAS CO., Houston. Docket G-9900 to add 8000 hp in compressor capacity at 4 existing stations.

NORTHERN NATURAL GAS CO., Omaha. Dockets G-2399, et al, for 654 miles of line and an additional 12,640 hp in compressor capacity. Also 15-mile 24-in. line from Ogden, Iowa to underground storage near Redfield; 168-mile 20-in. from Twin City area to Duluth and Superior; 92-mile 12-in. and 71-mile 10-in. line in South Dakota, and 307 miles of branch lines. Compressor additions and 15-mile line to test Redfield storage project approved.



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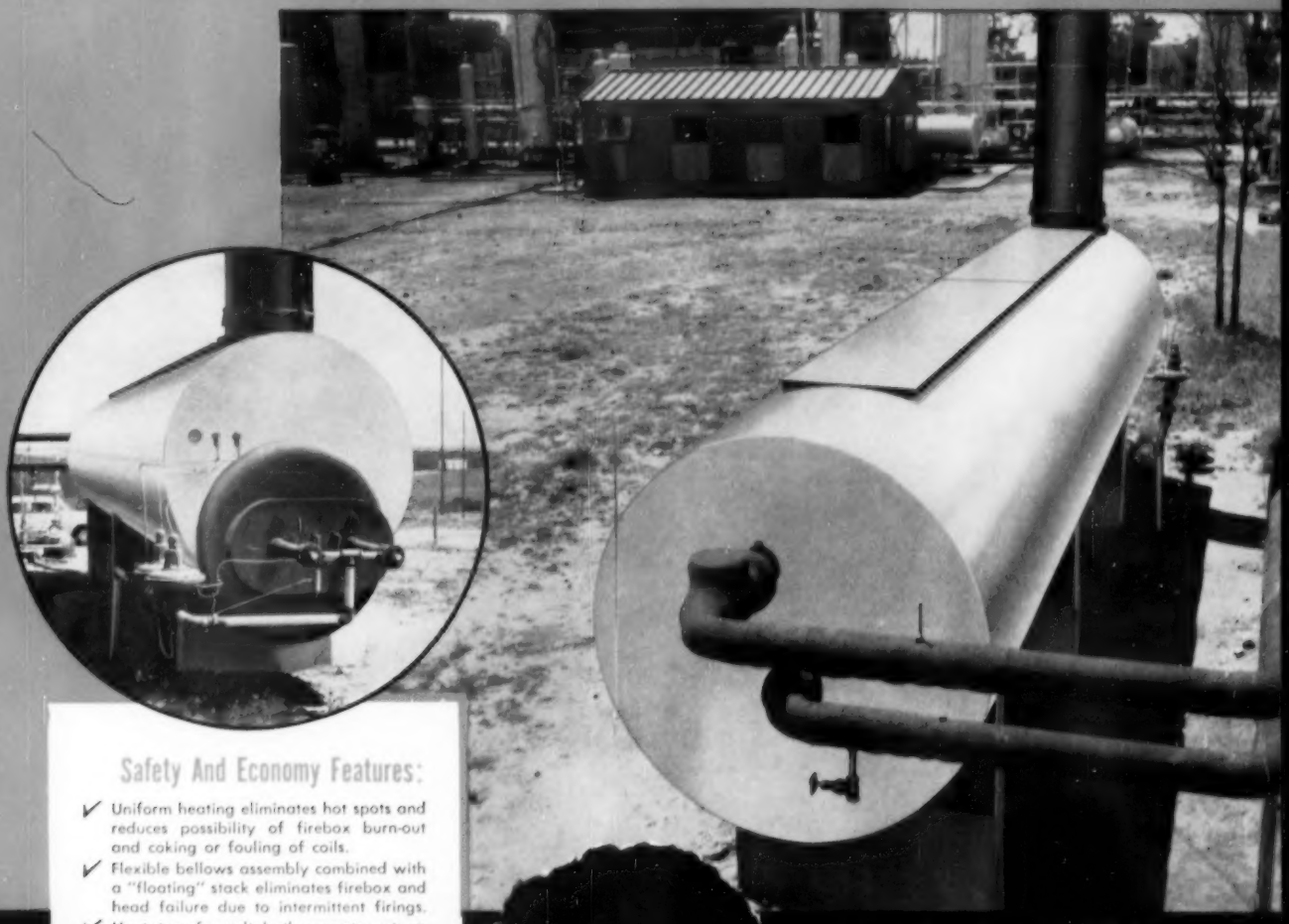

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